THE

# INDIAN FORESTER.

Vol. XIV.] January, 1888. [No. 1.

## A FOREST TOUR AMONG THE DUNES OF GASCONY.*

By Lieut.-Col. F. Bailey, R.E.

### CHAPTER I.

#### THE LANDES AND DUNES OF GASCONY.

#### Introduction.

Our party, consisting of M. Boppe, five English students, Mr. Beckington, an American gentleman interested in forest questions, M. Borel, a Swiss student, M. Takasima, and the writer, left Bordeaux early on the 26th April, 1886, for Arcachon. We were accompanied by MM. de Monteil and Moyse, Inspectors, and M. Foulon, Assistant Inspector, who were so kind as to conduct us to the various points of interest we had come to study. Leaving the train at La Teste, we spent some time in going over a resin factory close to the railway station; and then walked two miles across the dunes to Arcachon. After breakfast, we made an excursion to the Mouleau block of the forest of La Teste; and passing through it, gained the beach, which we followed, in a southerly direction, for a considerable distance, until we reached a portion of the dunes, where a forest—which had previously been established—was sold in 1863 to a private proprietor. He has neglected to maintain the works, and the result is that the forests are being gradually ingulfed. Our long walk home over the deep sandy track, in a

* Reprinted from "Transactions of the Scottish Arboricultural Society," Vol. XI., Part iii, 1887.

heavy shower of rain, the last few miles being in almost total darkness, was the least enjoyable part of the day.

Next morning, we travelled some miles by train, and then walked into a portion of the forest containing a number of old cluster pines (*Pinus pinaster*), which have been worked for resin for the last 150 or 200 years. We then walked to the village of La Teste, and caught the evening omnibus to Arcachon.

On the 28th, we travelled by train to Labouheyre, where we were met by M. Mörch, Assistant Inspector, and M. Lamarque, *Garde-Général*. The latter gentleman has been employed here since 1850, and has supervised the fixing and planting of 85 square miles of dunes. Accompanied by them, we drove to St. Eulalie, a distance of 12½ miles, stopping on the way to look over a factory, established in the forest for the manufacture of oil from subsubstances contained in the pine wood; we then mounted ponies, and rode to the sea-shore, for the purpose of inspecting the works that have been there erected to check the formation of dunes. We reached Mimizan, where we were to sleep, late in the evening.

Next day, we rode to another part of the sea coast, to look at some works more recent than those we had previously seen, and also to study a locality in which they have been neglected, and must now be partially destroyed and afterwards reconstructed. We then returned to Mimizan, and drove back to Labouheyre, where we visited a factory belonging to the railway company, in which pine sleepers and telegraph poles are impregnated with sulphate of copper. In the evening we took the train for Dax, on the banks of the Adour.

What we saw and learnt while among the dunes will now be briefly treated of under the following heads, *viz.* :—

1. General Description.
2. Construction of the Works.
3. Treatment of the Cluster Pine.
4. Tapping for Resin.
5. Manufacture of Products.
6. Utilisation of the Wood.

## General Description.

From the mouth of the Gironde down to Bayonne, a distance of some 125 miles, the western portion of the departments of Gironde and Landes forms a vast plain, about 18 or 20 miles wide, the soil of which is sandy and extremely poor. This tract of moor-

land (*landes*), which gives its name to the southern of the two departments, is inhabited by a population, formerly almost entirely pastoral, whose villages are scattered over it, and who cultivate scanty crops upon the fields surrounding their dwellings. But from time immemorial, and until comparatively recent years, the *landes* have been subjected to a never-ceasing invasion by sand, which, driven over the plain from the sea-shore, in the form of moving hills, called *dunes*, has completely covered a strip of 8 or 9 miles in width, and would, if unchecked, have ultimately laid waste the entire district. The aspect of the country, before steps were taken to improve its condition, must have been uninviting in the extreme; the *lande rase*, or barren moorland, stretching towards the sea, was then bounded by the *dunes blanches*, or white sand-hills, which, rising near the coast to a height of some 230 feet, had already buried below them many a village spire, and their irresistible advance seemed to render certain the destruction of everything lying in their path. The church of Mimizan has been thus partially covered; and, at a short distance from the village, a mound was pointed out to us, under which lies a buried hamlet. The village church of Soulac was completely overwhelmed, but was disinterred a few years ago; and M. Lamarque told us that he often ties his horse's bridle to the top of a certain church steeple!

But this state of desolation no longer exists. The barren moorland is now stocked with a nearly continuous forest of the cluster pine (*Pinus pinaster*), which, covering also the rolling dunes, has completely arrested their advance; and from various elevated points which we ascended near the coast, as well as from La Truc, in the forest of La Teste, the dark green undulating upper surface of the pine forest meets the deep blue of the western sky, and, looking landwards, there is nothing else to be seen. Indeed, throughout the many miles we travelled by rail, by carriage, or on horseback, through this part of the country, we became positively weary of the monotonous appearance of these trees. They are, nevertheless, undoubtedly the saviours of the land. They not only avert the destruction of existing fields and villages, but also profitably occupy vast areas of sand-hills, and of the low-lying, marshy, and unhealthy ground between them; and they thus provide employment for the population, who are nearly all engaged, during the summer months, in the collection of resin, and, at other times, in felling, cutting up, and exporting timber, or on other work which the forests offer to them. The people, however, still keep large flocks and herds, the guardians of which are to be seen, mounted on stilts

about 3 feet high, driving or following their animals through the dense undergrowth of prickly gorse and other shrubs.

The climate may be described as a mean between that of the Parisian and Provençal regions. The annual rainfall, of from 28 to 32 inches, is well distributed, so that the air seldom becomes excessively dry, as it does during the summer on the shores of the Mediterranean ; and thus, where the quality of the soil admits of it, a fairly varied vegetation is produced. But this condition is rarely satisfied, for the deep soil of the dunes is excessively poor, and the number of species growing on it is extremely limited. Very few shells are found on this coast ; the soil contains but little lime, and not more than from 3 to 6 per cent. of substances other than fragments of quartz. It is surprising to note what a luxuriant vegetation is produced under such circumstances. The cluster pine, which is mixed in places with a few oaks (*Q. pedunculata*), and a small proportion of other species, attains considerable dimensions ; and there is a dense undergrowth, consisting of broom, gorse, heather, ferns, and other plants, which commonly flourish on silicious soil. On the old plain of the *landes*, the sand is mixed with a considerable quantity of vegetable *débris*, and contains much iron, an impermeable stratum of ferruginous sandstone (*alios*), mixed with more or less organic matter, lying at a short distance below the surface.

The first works were undertaken here, in the year 1789, by M. Brémontier, an engineer, whose memory is honoured at Labouheyre by a bust, mounted on the same pedestal upon which, until the days of the Second Empire closed with the disasters of 1871, stood the statue of Napoleon III. *Tempora mutantur!* The Forest Department took charge of the operations in 1862. But it is certain that the cluster pine either grew spontaneously in this region, or had been introduced into it, long before M. Brémontier's time ; for in the old part of the forest of La Teste, near Arcachon, we saw trees which must have been 200 years old, and the process of extracting resin from which had apparently been carried on for at least 150 years. This pine, which now constitutes the principal wealth of the district, is eminently adapted for the use to which it has been put ; it grows splendidly on the soil and in the climate of the south-west coast, while it possesses a well-developed tap-root and strong lateral roots, which send down numerous secondary vertical roots to force their way deeply into the soil, thus holding it together, and enabling the tree to draw its supply of moisture from a great depth ; at the same time the resin which it yields is very valuable. Although the cluster pine is found north of the

Gironde, it is there much less vigorous and yields less resin ; while in the valley of the Loire it no longer grows spontaneously, and it loses nearly all its valuable qualities.

A special law relating to the dunes was enacted in 1810, its principal features being that the State can order the planting up of any area which, in the public interest, requires to be so dealt with ; and that when the land belongs to communes or private proprietors who cannot, or do not wish to, undertake the work, the State can execute it, reimbursing itself, with interest, from the subsequent yield of the forest. As soon as the money has been recovered in this manner, the land is restored to the proprietors, who are bound to maintain the works in good order, and not to fell trees without the sanction of the Forest Department.

### Construction of the Works.

The dunes are formed by the combined action of the wind and sea. Each ebb tide leaves a quantity of sand, a portion of which dries before it is covered by the next flow ; it is then liable to be blown away by the wind. The individual sand grains, which are not, generally speaking, either sufficiently large to resist the force of the strong westerly breezes blowing from the sea towards the low plain which bounds it, nor sufficiently small to be carried away in the air in the form of dust, are driven along the surface of the ground, rarely rising to a height of more than 1½ or 2 feet, until they meet with some obstacle which arrests their course, and thus promotes the formation of a little mound. Up this mound succeeding sand-grains are propelled, and on reaching its summit they fall down the sheltered reverse slope at a steep angle. In this manner sand-hills or dunes, rising sometimes to a height of 200 to 250 feet, are formed, the line of their crests being, generally speaking, perpendicular to the direction of the prevailing winds, that is, in the case of the tract between the Gironde and Bayonne, parallel to the general line of the sea-shore. This action is not completely regular. The formation of some of the dunes is commenced close to the sea, while others have their origin at some distance from it ; and fresh importations of sand either add to the bulk of those already existing, or, being blown through breaks in the chain, pass on till they encounter some other obstacle. But the sand-hills themselves are kept moving slowly landwards by the wind, which drives the upper layer of sand from the gently-sloping outer face, up to the summit, whence it falls down the steep slope on the landward side ; and this process being continued whenever there is enough wind to produce it, the dunes are moved, or rather rolled,

inland by slow degrees. As fresh mounds are formed near the sea, which are in their turn moved onwards, it follows that, in the course of time, the whole surface of the plain has become covered with sand-hills, for a distance of several miles from the coast. The rate at which the sand thus advances is very variable. Sometimes, during many months, there is no perceptible encroachment, while at others the movement is very rapid, amounting to 60 or 70 feet in the year; the average annual rate is said to be about 14 feet. But the sand-hills do not move at an uniform rate of speed. Some, overtaking those in their front, become merged in them; while they all undergo changes of height and form, so that the whole surface of the country is continually in motion, being turned over and over to a great depth, and under these conditions it is impossible to grow anything on it. The source of the evil lies at the sea beach, and the first thing to do is, evidently, to stop fresh importations of sand. As regards the dunes already formed, it will be seen, from what has been said, that the movement, at any particular time, is confined to the sand then at the surface; and if this can be fixed, during the time necessary to enable a crop of herbs, shrubs, and young trees to be raised upon it, the movement of the entire mass will have been arrested.

We rode from St. Eulalie, through the forests, to the coast near Mimizan-les-Bains, where M. Lamarque explained to us that the system by which this is accomplished consists in promoting the formation, by the wind, of an artificial dune, close to the sea, and, generally speaking, parallel to the water-line at high tide. This mound absorbs the fresh importations of sand; and, under its shelter, sowings are made, which, extending gradually inland in parallel bands, fix and consolidate the surface of the naturally-formed sand-hills. Ultimately, the artificial dune is itself planted with trees, and the evil is then cured, for so long a time as care is taken to maintain the works, which are commenced as follows:—At a distance of about 165 yards from high-water mark, a wattled fence, 40 inches high, is erected, the pickets being driven 20 inches into the sand. This serves to arrest the sand, which is heaped up on the seaward side, a portion of it filtering through the wattles. After a time, the fence is overtopped, and the sand, blown up the outer face, forms a steep slope on the other side. A second wattled fence is then erected, about 6½ feet behind the first, and the space between the two becomes filled up, a mound rising over it. The sand which falls over this obstacle then stands at a high angle against the reverse side of the second wattle. In the centre of the mound, a palisade of planks, also 40 inches above and 20 inches below ground,

is erected—the planks, which are of pine sapwood, 7 inches or 8 inches wide, and 1⅛ inches thick, being placed ⅜ths of an inch apart. When the sand drifts up against them, a portion of it falls through the intervals, thus affording support on the other side; and when they have become nearly covered, they are raised about 2 feet out of the ground by means of a hand-lever and chains. This operation, which we saw done, is repeated from time to time, until the barrier has attained a height of about 25 feet, when a third wattle fence is constructed, at a distance of from 5 to 6½ feet behind the inner slope; and the top of the barrier is strengthened by means of a line of small fagots formed of pine branches, gorse, and other shrubs, which are half-buried vertically in the sand. The fagots, each of which weighs about 45 lbs., are placed at distances of 4½ feet from centre to centre. During the time that elapses before the last fence is overtopped, the palisade is not raised, so that the width of the base is increased, and the top becomes broad and rounded. When the palisade, which is now moved back a short distance, becomes overtopped, it is raised as before, an additional wattle being placed in rear of the work; and the building up of the mound, by the action of the wind, is continued in this manner, until it has attained its maximum height of from 40 to 45 feet, when its breadth is allowed to increase, until it stands on a base about 330 feet broad. The foot of the outer slope is then about 100 feet distant from high-water mark, the top being at least 165 feet broad, and the slopes standing at 35 or 40 degrees. This result is usually attained in from 15 to 18 years, but the rate of the barrier's growth is by no means regular. Strong and steady west winds are the most favourable; but when the sand is raised by squalls, it is sometimes carried inland in considerable quantities. The artificial dune must be broad at the top, and its profile must be such that the most violent storms do not easily "take hold" of it; but if these conditions are fulfilled, its maintenance is easy and cheap; and if the base of the outer slope be kept at the prescribed distance from high-water mark, the sea, even if it reaches it during exceptionally bad weather, does the structure but little damage.

The surface of the mound is consolidated by fagots, 12 to 14 inches in circumference, and 14 to 16 inches apart, buried vertically to a depth of 16 inches in the sand, and projecting 8 to 16 inches above ground. It is also sown with *gourbet* (*Arundo arenaria**), about 13 lbs. of seed being used per acre. This plant, which is a kind of grass, with an underground stem and strong interlacing

* Syn. *Psamma arenaria*, Hooker.

side-roots, has a remarkable power of keeping its head growing above the surface of the rising mound, the particles composing which are held firmly together by it.

The sand subsequently left by the tide, either travels along the shore, or is taken up again by the sea and deposited elsewhere. An artificial dune, constructed in the manner above described, now extends along the coast, for a distance of 125 miles, from the Gironde to the Adour.

As soon as the further importation of sand over the country has been arrested by the palisade, and the covering of the future plantations has thus been guarded against, the sowing of the ground in rear of it is at once undertaken. This is effected in successive parallel belts of about 20 yards wide, commenced at a distance of 5 yards from the line to which the inner slope of the dune will attain when it is completed. By beginning at this point, and working gradually away from the sea, the plantations are secured against injury by sand which has already passed the line of the barrier. If the sowings were begun elsewhere, they would soon be covered by the advance of the old naturally-formed dunes over them.

The land to be operated upon is roughly levelled, and a mixture, consisting of 11 lbs. of pine seed, 7 lbs. of broom seed, and 5 lbs. of *gourbet* per acre, is then sown broadcast, a palisade being erected at the inner limit of the belt, so as to prevent the seed from becoming buried under sand carried over it by land breezes ; this structure is moved back as the work progresses, so as to serve for the protection of other belts, as the sowing of each is in its turn undertaken. The sowings are carried on from October to May. The seeds are covered with branches and brushwood, laid like tiles or thatch, with their butt-ends towards the sea, and kept down by means of sand thrown upon them. The surface is thus temporarily protected, until the plants have had time to grow up and take hold of the soil. If the covering of branches is, at any time, disturbed by the wind, it must be at once re-adjusted ; and should it be found that any damage has been done to the seeds or seedlings, the ground must be re-sown and recovered with branches. The cost of the entire work, including the artificial dune, is said to amount to about £8 per acre. We, unfortunately, did not see the sowings in progress, but we saw some ground that had recently been treated in the manner described.

We visited the artificial dune of St. Eulalie—Mimizan, which is now nearly completed, and M. Lamarque explained the system to us. This barrier, commenced eighteen years ago, is now about 40

feet high, and, all the ground inland having been sown, there is nothing but young pine forest to be seen, as far as the eye can reach. What is now required is simply to maintain the artificial dune, which is done most scrupulously ; and whenever any movement of the surface commences, fagots are at once planted, and the surface is re-sown and covered. This operation was being carried out in places during our visit ; and we were assured that, if such precautions were neglected, the entire work would soon be destroyed. We saw, indeed, two instances where want of proper supervision had already produced this result. The first of these was a few miles south of Arcachon, where the land was sold, in 1863, to a private proprietor, who neglected to maintain the artificial barrier ; consequently, a "white dune" is now in process of formation, and is gradually ingulfing the pine forest established behind it. Some endeavours have been made to arrest the movement of the sand by the erection of wattled fences inland ; but these are of no avail, and the trees are being slowly but surely overwhelmed. As we mounted the new dune, from the side of the sea, we found the trees more and more deeply buried ; and at its summit we actually walked over the crowns of some which were completely covered. On the land side, the sand falls down in a steep natural slope, at the foot of which are seen masses of young seedlings, carpeting the ground between the older parent trees. It is said that nothing can be done to remedy this state of affairs, on account of the conditions under which the land was sold ; but special legislation seems urgently needed.

The second instance was seen a little south of the Mimizan dune, where, the subordinate in charge having neglected his work, the wind got under the covering of branches, for a distance of several hundred yards inland, and thus caused the formation of a number of large holes or pits with steep sides. If these were not dealt with, the whole forest would soon be destroyed. Matters have already gone too far to admit of mere local treatment ; and the only thing to be done is to dig up the *gourbet* and other vegetable growth, and allow the artificial dune to be breached, so that the holes may be filled up by the agency of the wind that [illegible]used them. But, when doing this, it will be necessary to erect [illegible] attled [illegible] nce on the inner side of the damaged surface, so as [illegible] ven[illegible] from being carried too far inland. A fre[illegible] then deposit itself over the plantation ; and [illegible] and the surface has thus been restored, [illegible] reformed, and the sowings re-made. [illegible] other course is possible. This is [illegible]

what incessant care and watchfulness are required to carry out an undertaking of this kind successfully.

(*To be continued*).

# THE INFLUENCE OF FORESTS ON RAINFALL.*

*Translated from the German by* B. H. BADEN-POWELL, C.S.

IN India generally,—that is to say excluding from our view the regions of higher elevation in the great mountain ranges,—*moisture* is the factor of first rank among the climatic conditions which influence the character of vegetation generally, and in an especial manner that of the forests.

*This will be readily understood, in a country lying between the* 8° and 35° North Latitude, and sheltered towards the north by the huge barriers of the Himalayan ranges and the Thibetan plateau.

At an early period of my experience in the forest districts of the Indian Provinces, my attention was directed to the observation of the relations existing between the mean annual rainfall and the character of the forests. In the year 1872, when on leave in Europe, I laid before the Geographical Section of the British Association † a map showing four principal zones or regions of equal annual rainfall. The data for the preparation of this map were but incomplete. They were drawn from various sources, principally from James Glaisher's Essay on the Climate of India (1863), which is printed as an Appendix to the "Report of the Royal Commission on the sanitary state of the Army in India." At that time information existed regarding the mean annual rainfall of 160 stations, but these tables were not critically sifted, nor (in many cases) altogether reliable. This map was published on a reduced scale with an article on *Ocean Highways*, in October 1872. The following zones or regions of rainfall were taken :—

1. Two "moist" regions or zones with "abundant" rainfall, *i.e.*, with a mean annual rainfall exceeding 75 inches (1[illegible]00 millimètres)—(1), the western zone on the west coa[illegible] the peninsula ; and (2), the north-eastern zone ; whi[illegible]ludes the coast-districts of Burma, East Bengal [illegible]nd extends westward along the outer ranges [illegible]ya in a long narrow strip, as far as the

---

[illegible] Meteorological Society by Sir D. Brandis, (late [illegible]

[illegible] the year.

southern slopes of the Dauládhár—an off-shoot of the North-West Himalaya, 32° 15′ North Latitude.

2. Closely following on these two "moist" zones, comes the region of "moderate rainfall," with an annual mean between 30 and 75 inches (760—1,900 m.m.): nearly half of British India belongs to this region.
3. Two dry zones, or regions of diminished rain supply show a mean annual fall between 15 and 30 inches (380—760 m.m.). The first (*a*) is the northern dry zone, a crescent-shaped, but not altogether regularly formed, belt extending across North-Western India: it embraces the greater part of Rájputána, a part of the Panjab, and a small portion of the North-West Provinces.

   The second (*b*) is the southern dry zone, which includes the interior of the peninsula of India, and includes the greater part of the Dakhan and of Mysore.
4. The "arid" or almost rainless region, includes Sind, the south Panjab and a great part of Rájputána. In these districts the yearly rainfall is very small (on an average less than (380 m.m. or) 15 inches), and is both uncertain in quantity and irregular in time of falling.

The boundary lines of these zones were arbitrarily selected; but their definition was at once facilitated and checked by the indications which the vegetation of these different localities afforded.

In the meanwhile, Mr. Henry F. Blanford had organized the Government Meteorological Department, and in the office of this department a revised edition of the rain-map was prepared and published in 1878.* This edition was based on the critically examined *data* of 222 stations. Up to the present time the four main zones above described have been retained, with the same general boundaries as those laid down in 1872.

A large scale map by Mr. Blanford, published in 1883, gives a more complete representation of the distribution of rainfall. It shows *nine* zones, and is based on the observations of nearly 1,300 stations.

The distribution of rainfall over the seasons of the year, in different provinces, is illustrated by three instructive maps which accompany the "Statistical Atlas of India" shown in the Indian and Colonial Exhibition of 1886. These exhibit the temperature and the rainfall in the hot season (March—May) in the rainy

* As an Appendix to J. S. Gamble's Manual of Indian Timbers, Calcutta 1881.

season (June—October), and the cold season (November—February).*

For the purpose of comprehending the relations subsisting between the forest and the rainfall, the four zones or regions originally adopted (as above described) are both well adapted and sufficient.

No explanation is needed in remarking that the natural distribution of forest trees in India is not *solely* dependent on the greater or less degree of moistness of climate. The teak (*Tectona grandis*) for instance is wanting in forest tracts north of 25° North Latitude, because the species will not stand the night frosts of the north Indian cold season. Even though it may be reared under garden cultivation as far as the 32° North Latitude, it cannot hold its own in the forest against other trees able to bear the cold. Sandal wood (*Santalum album*), the characteristic species of the southern dry zone, is not found in the similar northern zone; because there the temperature in winter is too low. On the other hand, species of *Acacia* and other trees are found in the northern zone which do not occur in the southern. Again, other species like the sál (*Shorea robusta*), require special soil-conditions, and are not found where these are absent, even though the climatic conditions may be otherwise favorable.

Moreover, the natural distribution of forest species depends on yet other factors, with which the climate and the conditions of the soil at the present time, have nothing to do.

In the eastern moist zone, in Assam, Eastern Bengal and Burma, species of the genera *oak* and *pine* occur in the hills as well as in the plains. But in the forests of the west coast of further India (in the western moist zone), both in the hills and in the plains, *oaks* and *pines* (as well as other genera) are altogether wanting; notwithstanding the fact that the climate closely resembles that of corresponding localities in Burma, that the soil-conditions are similar, and that the forests *have* many other species common to both zones. For the full explanation of these and similar facts, the study of the conditions of the present era is not sufficient: we must go back to the development of the plant-world in geological ages preceding our own.

Nevertheless there are very close relations between the character

* The latest collection of observations made regarding the rainfall in India is to be found in Blanford's Indian Meteorological Memoirs, Vol. III., Part I., the "Rainfall of India," Calcutta 1886, with rainfall maps for the three seasonal divisions of the year, according to observations up to 1883; and the Report on the Meteorology of India in 1884 which carries the data a year further.

of the forest and the amount of annual rainfall in India. These relations are best realized and exhibited by following attentively the gradual changes which takes place as we pass from the moister to the drier districts.

On the west coast of further India, for instance, the rainfall increases notably from north to south, attaining its maximum at the 13° North Latitude.

Let us imagine ourselves to be taking a journey into the interior, and commence by passing through the most densely populated part of the coast districts, where the emerald green rice fields are sprinkled over with cocoanut palms; we gradually ascend, as we travel eastwards, to low terrace-cultivation, occupying the valleys which branch off continually, one from the other, and are closed in by wooded hills: ascending still, we reach extensive tracts of luxuriant forest on the ghâts. In one part of these forests the trees lose their leaves during the dry season; and here the teak has its home. The valleys and the western slopes of the ghât mountains, on the other hand, are clothed with thick evergreen forest, consisting of a vast variety of deciduous trees mostly belonging to the families of tropical vegetation. The trees attain not infrequently, a general height of 180—200 feet, and the space between the stems is occupied not only by a dense undergrowth, but also by many young trees, the crowns of whose progenitors weave a thick roof of foliage overhead. Here and there through the forest may be found tree ferns, palms, and bamboos, which stamp the forest with a character of its own. This dense forest of evergreen deciduous trees is specially characteristic of the moist regions of tropical India; it is found to extend over the ridge of the ghâts in a mere strip along the summit of the eastern side, and in sheltered valleys and moist slopes. The further we proceed eastward from the ridge of the ghâts, the drier becomes the climate, and the character of the forest changes accordingly.

The sanatarium of Mahábaleshwar, well known as a hot weather resort from Bombay, lies in 18° North Latitude on the ridge of the ghâts, about 45 miles distant from the sea coast and 5,500 feet (1,380 metrès) above the sea level: Ratnagirí, the next large station on the coast, has a mean annual rainfall of 104 inches, and of this quantity nearly the whole falls in the five months of the south-west monsoon (June to October). When these warm air currents, laden with moisture, come in contact with the steep western face of the ghâts, they are driven aloft, and the result is a still heavier downpour of rain on the heights. Mahábalesh-

war has (taking the average of 30 years) a rainfall of 260 inches (6,604 m.m.), and of this quantity 256 inches are due to the five months of the south-west monsoon. But the moist zone does not extend far into the interior. From the ridge of the ghâts the country falls gradually eastward, towards the plateau of the Dakhan, which is intersected with lines of hills; the bottom of the valleys and the plain tracts having a mean elevation of about 1,600 to 1,700 feet (500 to 600 metrès). Some 10 miles eastward of Mahábleshwar, and at a somewhat lower elevation than this, lies Pánchgani, with a rainfall of only about 50 inches; and Poona in the Dakhan, at 18° 28′ North Latitude, and 1,840 feet (564 metrès) above the sea level, being also 30 miles from the edge of the ghâts, has a rainfall of not more than 28 inches. As already explained, a narrow belt of evergreen forest extends along the crest of the ghât mountains. When mountain spurs branch off from the main ghâts on the east side, (*i. e.*, inland,) the evergreen forest may still be found, but as a narrow strip along the crest of spurs. In the valleys the upper part of which (the rainfall being copious) is occupied by this evergreen forest, we find, immediately below, forests which in the dry season lose their leaves; and yet it is easy in this forest, to distinguish further, an inner and moister belt in which there is no teak, and an outer and less moist but warmer belt in which the teak is in its home.

Further eastward, in the dry climate of the Dakhan, another style of vegetation succeeds, in which the species of the "dry zone" prevail. They are not properly speaking forests, but thorny thickets, in which of course, when protected, trees grow up. But even here the influence of degrees of moisture in the soil can still be perceptibly traced. The dry stony hills are sparsely covered by a poor thorny scrub of different species from those which are found in the moister low lands along the rivers. Here, the well know babul (*Acacia arabica*) is the prevailing tree; it is a rather handsome and useful tree, widely distributed over almost all India, and found also in Africa and Arabia. In the southern dry zone this tree grows in the 'sailába' or low lands along rivers, but also elsewhere, where the black soil of the Dakhan, which has great water-retaining power, occurs.

In the Poona district the teak reaches its eastern limit, with a mean total rainfall of 30 inches in the year. The dry zone (with but little rain) has in this part of India a breadth of only some 100 miles (160 kilometrès), and to the north-east of the Bhima river, in hilly country with a somewhat moister climate, teak is again found.

It will be readily understood, that these different styles of forest pass one into the other by gradual changes, and that no sharp line of boundary between the zones of different degrees of moistness exists. It is, however, useful to establish such zones, as they much facilitate the understanding of the great variety which exists in the forest vegetation of India. It has been already mentioned that the white sandal (*Santalum album*) is very characteristic of the southern portion of the southern dry region. It is a small tree, the heart-wood of which is highly prized for its fragrance; while its solid, even, texture well adapts it for the purposes of the wood carver. The wood is in fact an important article of trade, and is exported in considerable quantities to China.

It is equally instructive to follow the changes that are observed in passing from the western moist zone to the "dry region" with uncertain rainfall, which includes a very considerable part of northern India. On the sea coast, Bombay (18° 54′ North Latitude) indicates the northern limit of the western moist zone. Further north, the rainfall rapidly diminishes. Surat has 42 inches, Broach 40, Kaira 33, and Ahmadabad only 30 inches. But the richly wooded valleys at the foot of the ghâts, have even here a much moister climate. They are occupied by valuable forest, in which the teak still shows rapid growth, and attains a considerable size. These are the so-called "Dangs," extending to 21° North Latitude nearly to the Taptee river, north-east from Surat. Also considerably further to the north a moist climate is met with, at some distance from the coast. Kaira (22° 45′ North Latitude), distant about 30 miles from the coast, lies in an open, woodless district, and has, as above stated, 33 inches of rain in the year. Godhra, 60 miles further east, and about 400 feet higher than Kaira, is surrounded by forest, which has been carefully preserved since 1870, and in the last 16—19 years the rainfall has reached 44 inches. In this region, the ghât-chain is lower, consisting of a broad irregular collection of hills, which gradually sinks in elevation till it merges in the extensive plateau of Málwá. It begins about 23 miles east of Godhra.

The district of which Godhra is the capital, is known by the name of "the Pánch Mahals." In the forest, teak is not very common, but the species still reaches the dimensions attained in the Dangs. Further north between 24° and 25° teak disappears, and with it a number of other trees, which in the moist, and moderately moist, zones are the associates of teak. Many of these latter species are again found in the forest tracts at the foot of the Himalayan range, where there is once more a moister climate;

and some of these species may be met with almost up to the Indus in the latitude of 33° North. The teak itself, as already stated, has its northern limit between the 24° and 25° North Latitude.

In the northern "dry" zone, the southern portion of which extends from Rájputána to the 24th parallel of North Latitude, the forest vegetation is sparse and poor. As we pass out of the moist tracts that border on this dry zone to the south and east, the change is very striking: many species cease altogether, while others, which in the moist tracts were either wholly wanting or found only occasionally here and there, become dominant. The country, as might be expected under the circumstances, is sparsely wooded, and such forest as there is, is naturally more highly valued, than in districts better off in this respect. On this account in this part of the dry region we come across the rare spectacle of forests which have been protected by the inhabitants themselves, or by their chiefs, for centuries past—the object being sometimes to preserve the game, sometimes to supply firewood for the larger towns, or charcoal for iron-works, and especially to yield a reserve of fodder for cattle in years of drought. In many of these forests the *Anogeissus pendula* is the prevailing tree: it belongs to the order *Combretaceæ*, and in January when the seed ripens, its leaves turn red, calling to mind the autumn-tints of northern latitudes. This species is also found here and there in the neighbouring tracts of the 'moderate' zone: it is, however, especially characteristic of the northern dry zone. In the southern dry zone it is not found.

The "arid zone or region," where rain falls but seldom and with great irregularity, sometimes in winter, sometimes in summer, is surrounded by the northern "dry region," horse-shoe-wise. Here trees grow only on the sea-coast (*viz.*, a narrow strip of mangrove jungle on the lower Indus delta), and in the neighbourhood of the river Indus and its tributaries, as far as the moisture from the summer overflow, or lateral subsoil percolation extends. In this tract, the State forests of Sind, dependent for their existence entirely on the river, cover about 400,000 acres. They consist for the most part of the already mentioned babul (*Acacia arabica)*. Going from the bank of the Indus through these forests towards the east, we soon enter the Indian desert, in which groups of trees and bushes can only be found, oasis-like, at rare intervals, on the moister spots. Only a few species occur, and most of them extend into the northern dry zone, while a few occur even in the southern. To these latter belongs the *Capparis aphylla*, a thorny leafless bush or small tree, with slender, green, branched, twigs, and covered in the hot season with a mass of scarlet (or

rather brick-red) flowers. It, like most of the species of the arid zone, is also at home in the deserts of Arabia, Egypt and Nubia. *Acacia Senegal*, a small, gnarled thorny tree, which in winter is covered with delicate (and sweet-scented) spikes of white and yellow flowers, is found as far west as the west coast of Africa about Senegal, and in India is confined to the "arid," and the northern "dry," zones. In its place, the southern dry zone has the *Acacia latronum*, (a tree with strong thorns,—often nearly 3 inches in length,—white and glossy like ivory,) and *Acacia planifrons*, called the "umbrella-thorn," because its crown, consisting of a mass of interlaced gnarled branches, thorns, and delicately pinnate leaves, grows on the top of the stems in the form of a flat dome or umbrella.

A change in character of the forest vegetation analogous to that described, is also observed on passing from the "moist" zone on the east and north of India, to the dry region. A long and narrow belt of forest is found along the foot of the Himalayas in a climate which is much moister than that of the woodless plains of Northern India lying in front. In this belt, up to 33° North Latitude, many species of tropical India are found, such as constitute a considerable portion of the forest in the peninsula and southern India. If a traveller proceeds from the middle portion of this belt-like district southwards, he must first traverse the woodless, Ganges valleys or plain,—woodless that is, now after many centuries of continued cultivation; but in uneven spots, where the original vegetation has escaped untouched, we still find many trees and bushes belonging to a comparatively dry climate. Southward again of the Ganges plain, we reach the mountain or hill districts of Central India, once more in a moister climate. Here in the less thickly populated tracts are extensive forests, which in their general character bear a considerable resemblance to those of the northern forest belt; although certain species which are not found at the foot of the Himalaya,—notably the teak, are here abundant,—indicating the southern latitude.

If again we start from the western portion of the northern forest belt, and proceed in a south-westerly direction, away from the mountains, we come to "the land of the five rivers," the Panjab, with a generally much diminished rainfall, and still further south to the desert of Rájputána and Sind. A distance of not more than 150 miles separates the forests of Dehra Dún at the foot of the Himalaya, (between the Ganges and the Jamna,) from the thorn jungle ("rakh" or "bír") of Hissár near the boundary of the Indian desert.

To the north of the sub-montane forest belt, rises the vast system of the Himalayan mountains. The exterior chains of hills, with a moist climate, have a rich forest vegetation, which, in the higher portions (over 7,000 feet) of the western districts, calls to mind that of Europe. But going northwards into the interior of the ranges, and approaching the rainless highlands of Tibet, the character of the vegetation—at the same elevation above the sea—changes. Many species, found in the outer ranges with a moist climate, disappear, and other species take their place; and even there the same species still occur, it is with a much slower growth. The deodar (*Cedrus Deodara*) which in the district about Simla (with a moist climate) attains a diameter of 2 feet in 80 years, in the dry climate of Kunáwar requires 200 years to reach the same size.

The relations between forest and rainfall in India are complex, but are also reciprocal. When the Government began same 30 years ago systematically to organize the conservation of the forests, the first object in view was to secure the continuous and permanent supply of the demand for wood and other forest produce, as well as to prevent the erosion of the mountain soil,—the washing away in the heavy rains of the loose soil, and the silting up of the beds of streams, and to put a stop to destructive floods which arose from landslips and other disasters on the mountain side.

At a later period, the Administration learned that, especially in districts with a dry climate, but even in moister districts, in exceptionally dry seasons, the growth of grass is richer, and more productive as a reserve of fodder for cattle, than on the barren open plain land. In years of famine and drought, the want of fodder and consequent mortality among cattle, are among the most serious calamities; and on this account the value of a well ordered system of forest conservancy, in such districts and at such crises, becomes simply incalculable.

That forest conservancy and afforestation, even on a large scale however, should have any considerable influence in increasing the annual rainfall, is a matter, which up to the most recent times, we have hardly dared seriously to hope.

But it is nevertheless true, that in the last few years facts have become known which certainly, so far, point to the conclusion that the conservation of forest in several localities has resulted in the increase of the mean annual rainfall. In that part of the Central Provinces which lies between the Nerbadda river and the plains of Nagpur and Raipur, and including the Sátpúra hills, the forest

has been protected for a series of years, and more particularly, it has happened, that a total area of about 600,000 acres has been successfully protected against the yearly fires during the hot dry season. As a result of this protection, many localities once showing great gaps in the forest, and others where large blanks and barren strips occurred, have now become filled up with a compact forest growth. In respect of these localities, Mr. H. F. Blanford says (page 12 of his Annual Report of the Meteorological Department of India, 1885-86)—we have for the seven stations named below, complete records of the rainfall from 1865 or 1867 up to the present time. The comparison of the annual average before and after 1875 may thus be represented :—

| Station. | Annual Average in Inches. Before 1875 | Annual Average in Inches. After 1875. (1876—1885) | Difference. |
|---|---|---|---|
| Badnúr (1867-75), ... ... | 38·83 | 47·83 | + 8·00 |
| Chhindwára (1865-75), ... ... | 41·43 | 48·48 | + 7·05 |
| Seoni, do., ... ... | 52·07 | 54·76 | + 2·69 |
| Mandla, (1867-75), ... ... | 53·58 | 56·32 | + 2·74 |
| Burha, do., ... ... | 64·51 | 71·65 | + 7·14 |
| Biláspur (1865-75), ... ... | 41·85 | 54·81 | + 12·96 |
| Raipur (1866-75), ... ... | 51·59 | 54·41 | + 2·82 |
| Annual average, ... | 49·27 | 55·47 | + 6·20 |

40 years yearly observations at Jabalpur at the northern foot of the Sátpúras, and 37 years observations at Nagpur on the south side, are allowed a probable error (calculated at a 10 years' mean) of 5 per cent. If such be allowed for each of the seven stations above tabulated, that would amount to a deduction in the totals, of 2 or 3 inches. Further, it appears from a comparison of the rainfall figures of all India, that for the 10 years 1876-85, the mean annual fall was 0·66 inches greater than that observed in the 11 years for 1865—1875. It would also be justifiable to attribute about one-half of the difference (½ of 6·20 = 3·10 inches) to purely local causes. Mr. Blanford further adds that these results, do not of themselves afford a positive proof of the influence of forest conservation ; since it is possible that the earlier observations are less reliable than the later ones ; but he considers that these facts are at least to be accepted as a contribution to the already existing data which exist that such an influence may really be exercised.

To these conclusions of Mr. Blanford's I would add, that in the districts of the Central Provinces, "dahyá" cultivation (the system of cultivation by burning the forest), which formerly was the rule throughout these hills, has for the last 60 years, nearly altogether ceased: and that the operations undertaken to protect the forest against the annual fires in the hot season, were at first (in 1864) crowned with success only in a limited area, and were gradually extended over the whole area (600,000 acres) up to the year 1875.

A much longer series of observations from a much larger number of stations in this locality, as well as in other parts of India, where a regular conservation of the forest to a considerable extent, and especially where the annual fires have been continuously kept out, will be necessary, before a certain conclusion can be drawn. Above all things must the relations in question be studied and considered in connection with the circumstances of each locality. For example, it is not clear at the first glance, why (referring to the foregoing Table) Seoni and Mandla show a much smaller increase than other stations. But so much can already be stated, that if forest conservancy in the different provinces of the Indian Empire, is developed and extended in the way in which it has been begun, it will, in many cases, be the means of considerably alleviating the sufferings of the agricultural population, in years of drought and famine. Not only for the forest, but also for the land and its agricultural produce, is the rainfall a factor of the greatest importance. Notably, the dry regions and the neighbouring tracts of moderate rain supply, suffer from time to time by the irregularity or unseasonableness of the rainfall, or through occasional years of drought, which occur only too frequently. If even in a slight degree, forest conservancy and afforestation on a sufficient scale, could be made to influence the rainfall in the way of increase, in unfavourable years, the advantage to the land and its people would be incalculable.

## INDIAN SEEDS IN NEW ZEALAND.

On the 19th of February, 1885, I sent to New Zealand the following seeds :—

| | |
|---|---|
| Shisham, ... ... ... ... | 140,000 |
| Wild olive, ... ... ... ... | 37,000 |
| Boxwood, ... ... ... ... | 71,000 |
| Chir, ... ... ... ... | 52,000 |

From Deoban were also sent a quantity of deodar seeds, *Pinus excelsa*, and *Abies Smithiana*.

A large number of the deciduous trees came up, but if I am right they were afterwards killed by frost.

Of the chir (*Pinus longifolia*) there are now about 20,000 trees alive, and from 3 to 15 inches high in the nursery (Hasenberg).

*Pinus excelsa* seeds (without name attached) have done moderately well, there being about 2,000 trees of 4 inches height.

*Abies Smithiana* not come up, in fact the seeds appear to be *Pinus excelsa*.

*Cedrus Deodara*. None have come up from both year's consignments. The cones last sent appear not to have been fertilized, as stated by Professor Kirk, F.L.S. The cones were packed in paper and rags, which were quite rotten when the tins were opened. A further supply of properly fertilized cones, packed if possible in their own needles (leaves), and carefully picked from the trees, and not collected from those shed on the ground, is desired, and the cones should be pulled before too ripe.

The plantation is at Auckland, near Wellington, on the North Island.

DEHRA DUN,
*3rd December, 1887.*

H. WARTH.

## NITROGEN GAS IN SWAMPS.

About five miles south-east from Dehra Dún station is a swamp, from which a stream issues, and forms one of the numerous sources of the Suswa river in the Dehra Dún.

The swamp is lined with forest trees, amongst which occur *Quercus incana*, and also bushes of wild coffee and numerous wild citrons. From the bottom of the swamp gas bubbles rise here and there, and when the mud is disturbed by thrusting a stick through it, gas invariably follows. I would long have liked to observe and obtain marsh gas, $CH_4$, from a swamp, and so I collected several glass flasks of this gas. I soon found however that, as on many previous occasions, I had again failed to obtain true marsh gas. The gas would not burn, neither did it maintain combustion. I thought it might be carbon-dioxide, but on shaking it with much quick-lime there was no absorption; nor did I obtain a precipitate with dilute lime water. Further, after holding a bottle full of the gas mouth downwards, over another bottle with the mouth upwards, and filled with air, no intermixture took place. The lower bottle

remained full of air, in which a burning chip of wood continued to burn, the upper bottle retained the gas, which extinguished a chip of wood instantly. The gas must therefore be lighter than air. These tests, though only made roughly in camp, convinced me that the gas rising from the swamp is nitrogen, which might contain at the most a mere trace of oxygen.

It would be interesting if such gases were examined elsewhere, and especially a notice of pure marsh gas would be welcome. The gas in the Dún was obtained in November 1887.

H. W.

## THE HUMANE SPORTSMAN.

In looking over a German book of sport, entitled "Das Waidwerk," the following introductory verses attracted my attention, and as they express concisely the sentiments of all true sportsmen, I thought they might be welcomed at this season of the year, when many "shooters" are on the loose. I send the original for your comparison.

Das ist des Jägers Ehrenschild
Dass er beschützt und hegt sein Wild,
Waldmännisch jagt, wie sich's gehört
Den Schöpfer in Geschöpfe ehrt!

Das Kriegsgeschoss der Hass regiert,
Die lieb zum Wild den Stutzenführt:
Drum denk' bei Deinem täglich Brod
Ob auch Dein Wild nicht leidet noth.

Behüt's vor Mensch und Thier zumal!
Verkürze ihm die Todesqual!
Sei aussen rauh, doch innen mild,
Dann bleibet blank Dein Ehren schild!

The sportsman's only free from blame
When he preserves and shields the game,
Declines to slay by unfair means
And ever towards mercy leans!

Hate guides the bullet's flight in war,
Let kindness be the sportsman's law:
You, when you plan the creature's good
Revere its Maker as you should.

Protect 'gainst man and animal!
Let the death shot be merciful!
Thus shall the sportsman's name remain
Without a spot, without a stain!

Eyed Hooks.

## FOREST FIRES IN GREECE.

A friend who steamed through the Greek Islands in August last, informs us that he saw forest fires blazing in all directions on the hill sides, in the scrub forest which covers them. Marsh in 'Man and Nature' states that the Mediterranean regions, once the most fertile in the world, are now in great measure reduced to unproductive wastes, and no wonder if this barbarism is allowed!

## III. Notes, Queries and Extracts.

Influence of Forests on Rainfall.*—Nearly connected with the question just discussed, is that of the influence exerted by forests on the rainfall; a question of the highest economic importance, to which renewed attention has recently been drawn by the eminent physical geographer, M. Woeikoff. In an instructive paper, originally communicated to Petermann's Metteilungen,† and subsequently published in translation in the Quarterly Journal of the Royal Meteorological Society, M. Woeikoff appeals emphatically to the evidence afforded by the Indian rainfall registers, in support of his contention that the action of forests is to increase the rainfall of a country. His appeal is directed chiefly to the contrast afforded by the Assam rainfall with that of the Gangetic valley plain, in about the same latitude, and the same distance from the sea; and he apparently attributes the great difference displayed by these two provinces, wholly or mainly to the fact that, while the former is extensively covered with forest, the latter, up to the Terai, is a broad sheet of field cultivation.

From what has been said in the foregoing pages, of the geographical circumstances affecting rainfall in India, and of the conditions prevailing in Assam, it will be obvious that I am far from coinciding in such a view. Without denying or even questioning the effect of forests as one element of the result, the conclusion thus formulated seems to me far too sweeping. M. Woeikoff considers, and I think rightly, the action of forests in enhancing the rainfall to be two-fold. Firstly, they help to store the water by protecting the soil and so keep up a constant evaporation; and, secondly, by checking and obstructing the movement of the wind, they prevent the evaporated vapour being carried away, and tend to produce that calm state of the atmosphere that is favourable to ascending currents and local precipitation. But swamps, such as occupy large tracts of the Assam valley, and the numerous broad river channels that intersect it, must contribute a not unimportant quota to the vapour constituent of the local atmosphere; and the

* Indian Meteorological Memoirs, Vol. III., Part II., The Rainfall of India. By H. F. Blanford, Esq., F.R.S., Meteorological Reporter to the Govt. of India.

† *Op. cit.* 1885.

comparative stagnation of the air in the Assam valleys, and the exclusion of those dry westerly winds, which play so important a part in the meteorology of the Gangetic plain, are certainly due, in far larger measure, to the fencing in of the Assam valley by the Patkoi, Naga, Khasi, and Garo hills, and, as regards Upper Assam, to the interception of westerly currents by the mid-valley obstruction of the Mekhir hills, than to any retardation of wind movement that can be effected by the forests. Furthermore, the action of the surrounding hills, in setting up a diurnal convection of the humid atmosphere, and its consequent dynamic cooling and precipitation, an action which also takes place in the much less humid hill tracts of the peninsula, is a very important factor in the causes which contribute to produce the heavy spring rainfall of Assam ; a precipitation not very greatly inferior to that of the summer monsoon. The other, or passive, effect of hills in enhancing rainfall, *viz.*, the forced ascent of horizontal air currents, is less important in Upper Assam, (the tract more particularly referred to by M. Woeikoff,) although exhibited by the southern face of the Khasi hills, overlooking Sylhet, in a degree without parallel elsewhere in the world. But to the other causes, above specified, must certainly be attributed by far the larger part of that prevailing high humidity and copious rainfall, which foster the exuberant vegetation of the province, rendering it in the rich variety of its flora and its prolific insect life, comparable with the teeming productiveness of the Malay region.

The difficulty so conspicuously illustrated in the foregoing example, *viz.*, of disentangling the combined effects of a number of causes, all favourable to increased rainfall or the reverse, is one which renders it almost hopeless to seek for decisive evidence of the influence of forests, by any comparison of the rainfall of different provinces, or of areas sufficiently large to display the contrasted effects in a striking and convincing manner. The best, and perhaps, only satisfactory kind of evidence, were it obtainable, would be the comparison of the rainfall of one and the same tract, (one of at least some hundreds of square miles in extent,) for many years ; first while covered with forest, and again for many years after clearing. It is, however, not until a tract of virgin forest has been brought under the destructive operation of civilizing agencies that, as a general rule, any attempt is made to record its rainfall ; when, therefore, the conditions necessary to obtain one term of the comparison are rapidly disappearing. The reversal of this order of things, the conversion of bare, or at least partially wasted, tracts into protected forest, is one, however, of which India already fur-

nishes some examples, and with progress of forest protection may yet furnish more; and if due advantage be taken of these as they present themselves, it may yet be possible to obtain rainfall data which may afford valuable, and indeed practically conclusive, evidence on the point in question; even if not fulfilling, in all respects, the rigorous conditions of the logical method of differences.

One instance of the kind, on a scale large enough for all reasonable demand, has lately been brought to my notice by Mr. Ribbentrop, and has been quoted in my Report on the Administration of the Meteorological Department in 1885-1886; and, despite some shortcomings in the due verification of the data, shortcomings which it is now impossible to make good, it will probably, in the course of some years, as nearly fulfil the conditions of a test case, as we are likely to secure in an experiment of such magnitude. In some respects, indeed, the circumstances of this case are unusually favourable. The vicissitudes of the rainfall of the Central Provinces are smaller, proportionally, than those of any other province of an equally moderate average; and of the 22 stations, the rainfall registers of which will be brought in evidence, not less than 10 are regular meteorological observatories, working under the Meteorological Department of the Government of India.

The region, referred to in the first part of my Memoir on the Rainfall of India, as the Central Provinces, South, has been described "as a hilly and jungle-clad country, including some extensive fertile plains, especially that which surrounds Raipur." The northern portion consists of the range of broken table-lands and hills, here spoken of as the Satpuras, and these are largely clothed with forest. According to the most recent report of the Officiating Inspector General of Forests, the area of forest in the Central Provinces is estimated at 54,600 square miles, of which about nine-tenths are in or to the south of the Satpura range. The area of the Central Provinces, South, has been given, at page 12, as 61,000 square miles. Hence about five-sixths of the whole are under forest. Now, prior to the year 1875, these forests were systematically wasted, by the destructive method of cultivation, practised by the hill tribes of Gondwána, as of other wild tracts in India and Burma. It is known under various local names, such as *kumri*, or, in the Central Provinces, *dáhya* cultivation, and is thus described by Dr. Brandis: "A few acres of forest are felled one year, the wood is burnt and a crop of grain raised on the clearing; the next year this is abandoned, a fresh piece of forest is felled elsewhere, a crop is raised, and it too is abandoned in its turn; and so on, a fresh clearing being made every year."

It will be readily understood how, under such a system, in the course of some years, extensive forests may be devastated, even by a sparse hill population of nomad habits. And, accordingly, in the introduction to the Central Provinces Gazetteer, published in 1870, Mr. C. Grant speaks of the state of the forests in the following terms :—

"The tree forests of the Central Provinces have, however, been so much exhausted, mainly owing to the destructive *dáhya* system of cultivation practised by the hill tribes, that, except in one or two localities, the labours of the Forest Officers will, for many years, be limited to guarding against further damage, and thus allowing the forests to recover thmselves by rest. By far the greater part of the uncultivated lands, belonging to Government, are stony wastes, incapable of producing a strong straight growth of timber."

In 1875, the suppression of *dáhya* cultivation was taken systematically in hand; and in the course of a few years, with such success, that Mr. Ribbentrop writes in *1886* :—

"My attention was directed, during a recent visit to the Central Provinces, to the extensive growth of young forests, in areas formerly under *kumri* cultivation. Ten or fifteen years ago, such temporary cultivation was practised throughout the country, and thousands of square miles were thereby laid barren, year after year. Since then, this method of cultivation was stopped, and, though a great part of the area affected was subject to annual fires, a more or less dense forest growth has sprung up. I concluded that this must have had an influence on the rainfall, sufficiently appreciable to be gauged by meteorological records. The results, gathered from such records, are beyond exception, and show that, with the exception of stations situated in the cultivated valley of the Nerbudda, a steady increase of rainfall has taken place during the last ten years, and, as might be expected, especially during the last period of five years."

In dealing with the evidence of the rainfall registers, I shall in the first place, compare the averages of the nine or, in some cases, ten or eleven years, ending with 1875, (the year in which the suppression of the *dáhya* cultivation was taken in hand,) with those of the ten years subsequent, 1876—1885; and this I shall do, separately, for the stations within the area immediately affected by the forest preservation, and those at a greater or less distance therefrom. These latter are Saugor and Damoh, the forests near which have not been frequented by *dáhya* cultivators, or which are surrounded by Native States in which no change of system has been attempted, *viz.*, Jubbulpore, Narsinghpur, Hoshangabad and Khandwa, in the fertile and highly cultivated valley of the Nerbudda, and where the tendency of late years has been towards an extension

of permanent cultivation; and Raipur in the centre of the great wheat-growing district of Chattisgarh.

*Comparison of the average rainfall of nine to eleven years of* dáhya *cultivation with that of ten years of protected forests.*

A—In affected areas.

| Stations. | *Forests unprotected.* | | *Forests protected.* | | Increase. Inches. |
|---|---|---|---|---|---|
| | Period. | Rainfall. Inches. | Period. | Rainfall. Inches. | |
| Badnur, ... ... | 1867—75 | 39·83 | 1876—85 | 47·83 | + 8·00 |
| Chhindwára, ... | 1865—75 | 41·43 | 1876—85 | 48·48 | + 7·05 |
| Seoni, ... ... | 1865—75 | 52·07 | 1876—85 | 54·76 | + 2·69 |
| Mandla, ... ... | 1867—75 | 53·58 | 1876—85 | 56·32 | + 2·74 |
| Burha, ... ... | 1867—75 | 64·51 | 1876—85 | 71·65 | + 7·14 |
| Biláspur, ... ... | 1865—75 | 41·85 | 1876—85 | 54·81 | +12·96 |
| Sambalpur, ... | 1867—75 | 54·80 | 1876—85 | 67·93 | +13·13 |
| Dhamtari, ... | 1867—75 | 48·83 | 1876—85 | 46·90 | − 1·93 |
| Bhandára, ... | 1867—75 | 49·90 | 1876—85 | 57·79 | + 7·89 |
| Nágpur, ... ... | 1866—75 | 41·54 | 1876—85 | 51·85 | +10·31 |
| Wardha, ... ... | 1866—75 | 36·10 | 1876—85 | 46·63 | +10·53 |
| Brahmapuri, ... | 1867—75 | 53·95 | 1876—85 | 57·48 | + 3·53 |
| Chanda, ... ... | 1866—75 | 47·14 | 1876—85 | 54·29 | + 7·15 |
| Sironcha, ... ... | 1867—75 | 44·17 | 1876—85 | 48·38 | + 4·21 |
| | | | | Mean, ... | + 6·81 |

B—In unaffected areas.

| | | | | | |
|---|---|---|---|---|---|
| Saugor, ... ... | 1866—75 | 55·97 | 1876—85 | 40·62 | −15·35 |
| Damoh, ... ... | 1867—75 | 54·76 | 1876—85 | 46·82 | − 7·94 |
| Jubbulpore, ... | 1866—75 | 60·66 | 1876—85 | 56·28 | − 4·38 |
| Narsinghpur, ... | 1866—75 | 55·46 | 1876—85 | 50·40 | − 5·06 |
| Hoshangabad, ... | 1866—75 | 47·08 | 1876—85 | 57·73 | +10·65 |
| Khandwa, .. | 1867—75 | 34·74 | 1876—85 | 33·32 | − 1·42 |
| Raipur, ... ... | 1866—75 | 51·59 | 1876—85 | 54·47 | + 2·92 |
| | | | | Mean, ... | − 2·94 |

The contrast, thus shown, is sufficiently striking. But, taken as they stand, it can hardly be said that the figures do more than

afford a certain presumption in favour of the view, that the difference, shown by the two series of stations, is to be attributed to the preservation of the forests. In the first place, as I shall show elsewhere, the probable error of a ten years' average of a station in the Central Provinces is about 5 per cent., and this may be either in excess or defect. In the extreme case of the errors being in opposite directions in the two decennial periods compared, the greater part of the apparent increase of list A would vanish. And, in the second place, the majority of the stations in the second list lie to the north of the Satpura range; those of the first list either on the range itself or to the south of it; and as this range about coincides with the southern margin of the track, commonly followed by the cyclonic storms of the summer monsoon, the distribution of the rainfall might be much affected by the fact of a series of such storms following a more southerly or more northerly path; or by the western branch of the monsoon, which brings nearly the whole rainfall to the region south of the Nerbudda valley, being, in several years, relatively to its normal average, stronger and more rainy than the eastern branch, which contributes to the rainfall north of that river.

But there is another way of dealing with the facts, which will not be open to such objection. Any effect, really due to forest protection, must necessarily have been progressive. Some few years were passed in inducing the jungle tribes to take to settled cultivation; again, the reproduction of the forest growth on the tracts, formerly denuded, is a process requiring many years for its accomplishment; and, finally, the protection of the forests from destruction, by annual fires in the dry season, has been steadily extended year by year. If then it should appear, on comparing the rainfall of the affected tract in successive years, that the increase has been steadily progressive, and, on the whole, in a degree commensurate with the average difference of the two decennial periods above compared, the probability of such increase having been brought about by the protection of the forests will be enormously enhanced.

The data for this comparison are afforded by the following table, which exhibits in the second column the mean rainfall of the fourteen stations enumerated in the A list of the previous table in each year from 1867 to 1885. The third column gives what may be termed progressive averages. Each average is that of five years, obtained by the formula

$$c' = \frac{a + 4b + 6c + 4d + e}{16}$$

wherein *a, b, c, d, e* represent the mean rainfall in any five consecutive years, and *c′* the progressive average for the third year of the series. As a standard of comparison, I give, in the fourth column, the average rainfall of the whole Indian area, (with the omission of unrepresented tracts,) the data being deduced from the table on a subsequent page of this Memoir, and completed from the annual reports. The average rainfall is taken at 42 inches. Lastly, the fifth column shows the progressive averages of the rainfall of India computed from column 4.

*Comparative Table of the mean annual rainfall of the forest region in the Central Provinces and of India generally from* 1867 *to* 1885.

| Year. | Condition. | *Central Provinces.* Annual mean. | *Central Provinces.* Progressive average. | *India.* Annual mean. | *India.* Progressive average. |
|---|---|---|---|---|---|
| | | Inches. | Inches. | Inches. | Inches. |
| 1867, ... ... | Under *dáhya.* | 55·08 | ... | 44·8 | 40·2 |
| 1868, ... ... | | 33·59 | ... | 35·4 | 40·3 |
| 1869, ... ... | | 47·97 | 45·28 | 42·4 | 41·0 |
| 1870, ... ... | | 50·42 | 47·71 | 43·5 | 42·6 |
| 1871, ... ... | | 45·52 | 48·45 | 42·9 | 43·0 |
| 1872, ... ... | | 53·31 | 47·47 | 44·3 | 41·7 |
| 1873, ... ... | | 39·18 | 47·02 | 37·5 | 42·2 |
| 1874, ... ... | | 50·48 | 48·85 | 46·6 | 42·4 |
| 1875, ... ... | Protected. | 56·60 | 50·15 | 44·4 | 42·4 |
| 1876, ... ... | | 42·32 | 49·58 | 37·5 | 40·5 |
| 1877, ... ... | | 52·50 | 50·40 | 37·7 | 41·1 |
| 1878, ... ... | | 52·47 | 52·60 | 48·3 | 43·3 |
| 1879, ... ... | | 55·67 | 53·85 | 43·7 | 43·5 |
| 1880, ... ... | | 51·83 | 54·50 | 40·4 | 42·4 |
| 1881, ... ... | | 57·90 | 55·31 | 42·1 | 42·4 |
| 1882, ... ... | | 54·22 | 56·52 | 44·6 | 43·0 |
| 1883, ... ... | | 57·73 | 58·57 | 41·9 | 43·1 |
| 1884, ... ... | | 64·63 | ... | 43·7 | ... |
| 1885, ... ... | | 57·43 | ... | 43·1 | ... |

The variations exhibited in this table are represented graphically in *Fig.* 1, Plate XIX.*

Now the third column of this table shows, not only that the increased rainfall of the protected forest region has been, on the whole, progressive since 1876, (the year after protection was systematically enforced), but that its progression has been commensurate with the increase of the decennial average shown in the previous table; a very important point. As compared with the general average of the period antecedent to 1875, a rainfall of 48 inches, in integral figures, had risen to 58 inches in 1883; an increase of more than 20 per cent. Whether this increase will be sustained, at its full amount, by the results of future years is, however, very questionable. The rainfall of 1884 was extraordinarily high, and whereas, as may be observed in the graphic representation of these changes, the rainfall of the Central Provinces rises and falls, *pari passu* with that of the whole of India, in a somewhat remarkable degree, (having regard to the comparative smallness of its area,) the progressive average rainfall of India, as a whole, for 1883, was nearly 3 per cent. above the general average between 1867 and 1875. But, after making all due allowances, in so far as any legitimate conclusion can be drawn from the experience of the last 10 years, it would seem that, owing to some local cause, the mean rainfall of the afforested region of the Central Provinces here considered, an area of nearly 50,000 square miles, has been increased in a very remarkable degree; and I am unable to assign any other probable cause for this than that of the protection and consequent restoration of the formerly wasted forests.

The evidence, thus afforded, in favour of the influence of forests on rainfall appears to me to be of considerable weight and importance; in virtue both of the magnitude of the area yielding it, and the apparent distinctness of the result. With one exception, and one only, it fulfils all the conditions of a rigorous test case. The area is one and the same; the history of the changes to which it has been subject are definitely and accurately known; and, as will be shown elsewhere, the rainfall registers, if but few in proportion to the area, are sufficient to afford a datum, the probable error of which is small in comparison with the magnitude of the effect shown. The only remaining points, to which exception may conceivably be taken, are the trustworthiness of the records used, and the sufficiency of the periods compared to yield valid averages.

On the first of these points, I can add but little to what has been already written in the introduction of this Memoir. Speaking

* Not reproduced.—[ED.]

from recollection, (for I have been unable to obtain the desired verification of the fact from official records,) I believe that new rain-gauges of Glaisher's pattern, from one of the principal London makers, were furnished to all the stations, the registers of which are here dealt with, about the year 1867, at all events before 1870; that is to say, at or near the beginning of the period for which the registers are complete; and there are therefore no grounds for suspecting that the increase of the registered rainfall, during the last ten years, has been influenced by a change in the instrument used. And this is the most important consideration. With respect to the registering agency, as far as I have information, it has been the same throughout. Dr. S. C. Townshend, who was Sanitary Commissioner of the Central Provinces from 1866 or 1867, and who, in 1868, established the observatories, which, in 1875, were incorporated in the imperial system, took much personal interest in all the meteorological work of the province; and there is no doubt that his action was attended with beneficial results. But this change, like that of the instruments, dates from the beginning of the period now under consideration, at all events from 7 or 8 years anterior to 1875.

On the second point, *viz.*, the sufficiency of the periods compared, to yield valid averages, I have ascertained that a ten years' register of the Central Provinces stations, Jubbulpore and Nagpore, has a probable error of 5 per cent.; *viz.*, in the case of Jubbulpore 2·7 inches, in that of Nagpore 2·2 inches; and these may be taken as fairly illustrative examples of the whole province. These, however, are the probable errors of individual stations; and, as may be easily shown, and will be further demonstrated hereafter, the mean rainfall of a whole province is much less variable than that of a single station; for, if we take the average of either the first 10 years or the last 10 years of the figures in the third column of the table, on page 40, we have—

Average of 1867—1876, 47·45 inches; probable error, ±1·56
" " 1876—1885, 54·67 " " " ±1·22

which is but little more than half the probable error of either Jubbulpore or Nagpore for an equal period. This is small in comparison with the difference of the two averages, *viz.*, 7·22 inches. Assuming the extreme case, that the first average is 1·56 inches below the real mean and the second 1·22 inches above it, these differences being both due to fortuitous and not steadily progressive causes, there would still remain 4·44 inches of increase unaccounted for. This is, perhaps, not such as to warrant conviction that the average rainfall of the Central Provinces south of the Nerbudda

has really increased by that amount; still less does it warrant the positive assertion that such increase, assumed as real, is due to the preservation of the forests; but at least, in so far as any inference is admissible from such data, the evidence seems to afford much support to that view.

Direct observations of a character, similar to those of Professor Ebermeyer in Bavaria, *viz.*, comparative measurements of the rainfall, at pairs of stations near the margin of forests, the one within, the other without the forest, have been carried on in Dehra Dún and Ajmere, during the last year or two, by officers of the Forest Department. Some of the results of these were given in the Administration Report of the Meteorological Department for 1885-86, and I have since visited the Dehra Dún stations and some of those in Ajmere. In the case of the former, the conditions are satisfactory; in so far, that the forest, on the site of the observatories, is a vigorous growth of, chiefly, *sál* coppice,* with a well-defined boundary; and the observatory stations are, in the one case, well within the forest, in an opening only just large enough to prevent the gauge being sheltered, or its contents unduly added to by the drip of the trees; in the other in an open *maidan* of coarse grass and scrub, with only a rare tree here and there. But the interval, between the two stations of each pair, is hardly enough to show the full influence of the forest in the one case, or to exclude it in the other; and it can only be expected that, under such circumstances, any difference depending on that influence will be very small.

There are two such pairs within about 6 miles of Dehra Dún, on the skirts of the Sivalik forests, the one at the Ramgarh, the other at the Rajah's forest. In the case of the Ramgarh forest, at which the observatories have been longest in existence, the two observatories are 750 yards apart, the outer 400 yards from the forest boundary, the inner 350 yards from it. At each station, there are two rain-gauges, the one on the ground, the other at a height of 60 feet; being perched on the summit of a scaffold, which raises it above the top of the neighbouring trees. The rain-gauges are

---

* As testifying to the importance of this condition, I extract the following from a letter lately received from Sir D. Brandis, for many years Inspector General of Forests in India:—

"I would draw your attention to a point which I used to urge in India whenever I wrote on the subject, *viz.*, that forests, in order to exercise an effect [on the rainfall], must be dense, and must not consist of a few bushes and trees here and there. Fire protection alone has the effect of making the forest grow up dense, and I am disposed to think that the large extent of fire-protected forest in the Central Provinces may, in course of time, affect the rainfall."

of Symons' pattern, 5 inches in diameter, and the measurements are all made with the same measure-glass. The observer has been regularly trained in his duties, (which include keeping four registers of temperature and humidity, under corresponding conditions,) and his work seems to have been regularly performed. The results for the years 1884 and 1885 are given in the following Table :—

| | | | 1884. | | | | 1885. | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Outer Lower. | Outer Higher. | Inner Lower. | Inner Higher. | Outer Lower. | Outer Higher. | Inner Lower. | Inner Higher. |
| January, | .. | .. | .. | .. | .. | .. | 4·20 | 4·56 | 4·48 | 4·63 |
| February, | .. | .. | .. | .. | .. | .. | 0·85 | 0·77 | 0·70 | 0·67 |
| March, | .. | .. | .. | .. | .. | .. | 0·48 | 0·42 | 0·39 | 0·36 |
| April, | .. | .. | .. | .. | .. | .. | 0·44 | 0·45 | 0·55 | 0·50 |
| May, | .. | .. | .. | .. | .. | .. | 5·35 | 5·06 | 5·99 | 5·79 |
| June, | .. | .. | 3·66 | 3·61 | 4·07 | 3·88 | 10·31 | 9·75 | 10·76 | 10·61 |
| July, | .. | .. | 25·64 | 24·72 | 26·46 | 26·44 | 9·81 | 9·27 | 9·90 | 9·88 |
| August, | .. | .. | 21·18 | 19·88 | 21·74 | 21·23 | 44·64 | 43·56 | 44·91 | 44·45 |
| September, | .. | .. | 17·53 | 17·19 | 18·78 | 18·01 | 6·24 | 6·06 | 5·51 | 5·47 |
| October, | .. | .. | 0·28 | 0·26 | 0·39 | 0·37 | .. | .. | .. | .. |
| November, | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| December, | .. | .. | .. | .. | .. | .. | 3·45 | 3·48 | 3·49 | 3·52 |
| Total, | | .. | 68·29 | 65·66 | 71·44 | 69·93 | 85·77 | 83·38 | 86·68 | 85·88 |

The observations at the Rajah's forest extend over a shorter period. The stations are less than a mile distant from the former, and the arrangements are similar ; the surrounding conditions of each of the pair being strongly contrasted. The outer observatory is 1,750 feet from the forest boundary, the inner 1,000 feet within the forest, which is of the same character as the Ramgarh forest—

| | | | Outer Lower. | Outer Higher. | Inner Lower. | Inner Higher. |
|---|---|---|---|---|---|---|
| March | 1885, | .. | ? | 0·21 | 0·27 | 0·23 |
| April | ,, | .. | 0·06 | 0·32 | 0·42 | 0·36 |
| May | ,, | .. | 4·69 | 4·36 | 3·99 | 4·04 |
| June | ,, | .. | 10·47 | 10·07 | 11·70 | 11·42 |
| July | ,, | .. | 9·81 | 9·47 | 10·63 | 9·88 |
| August | ,, | .. | 47·50 | 46·99 | 45·87 | 45·87 |
| September | ,, | .. | 2·43 | 2·40 | 2·46 | 2·41 |
| October | ,, | .. | .. | .. | .. | .. |
| November | ,, | .. | .. | .. | .. | .. |
| December | ,, | .. | 3·40 | 3·43 | 3·54 | 3·45 |
| Total, | | .. | 78·36? | 77·25 | 78·88 | 77·66 |

In this case, while, in most months, the rainfall at the inner station is appreciably higher than at the outer station, as is shown both by the elevated and ground level gauges, this gross excess appears to have been nearly neutralized by falls in May and August, which were in excess at the outer station. The result of the evidence is therefore doubtful. But, in the case of the Ramgarh station, there does appear to be a decided balance of rainfall in favour of the inner station.

I do not give the results of the Ajmere observations, because, the difference of the conditions, within and without the boundary of the forest, as far as I have seen them depends, much more on the form and slope of the ground, than on the density of the forest growth; and I do not think the comparative observations have much bearing on the question at issue.

There remains one case which, although dependent on purely artificial conditions, might yet afford evidence of some weight in connection with the present subject, could we only be sure that the observations had been taken with the care and precaution, indispensable to any valid comparison.* In the very heart of the plain between the Ravi and the Jhelum, (two of the five rivers of the Punjab,) and about 50 miles to the south of Lahore, a vigorous forest has been established by planting, and irrigating the planted land from the Bari Doab Canal. The forest area covers 31$\frac{5}{8}$ square miles, and has now been established 20 years.† Outside the forest and to the east and south-east, are lands which are cultivated, also

* For the following information I am indebted to Colonel Home, R.E., late Secretary to the Punjab Government in the Irrigation Department of the Public Works, and now Secretary to the Government of India:—"Two gauges are placed side by side; the receivers are 4$\frac{1}{2}$ feet above the ground. One is an ordinary tube gauge; measurements made with a graduated rod. The other a Watson's continuous self-registering gauge, which is taken to pieces, cleaned and readjusted on 1st April yearly. The bearings of the gauge are silver plated copper tubes, and, with very ordinary care in adjustment, they register very correctly. Instructions about registering rainfall are very distinct, and I believe they are obeyed."

† Mr. H. C. Hill, Conservator of Forests in the Punjab, writes:—"Changa Manga is a compact block of 20,242 acres, of which 8,899 are wooded with planted sissu (*Dalbergia Sissoo*). The remainder is under ordinary scrub. The age of the plantation dates back to 1866-67; but little was done for 8 years, and the age of the forest may be taken as 16 years. The trees (excepting those in the canal avenue, averaging 63 feet,) of our best compartments average 50, 51, and 53 feet in height, and all compartments have an average of 40 or more.

"The watering of the forest begins in April and goes on more or less till September. Very little of it ever gets a second watering in the year; but that given is a good soaker of 3 or 4 feet depth of water. The ground to the east and south, except where two *rakhs* are touched, is all under cultivation and irrigated. Irrigation mostly from June to April."

with irrigation from the canal; and on the margin of this tract, 4 miles from the forest, is the small civil station, Chunian. Since 1864, a rainfall register has been kept regularly at Vahn, (within the forest, ½ mile distant from the nearest forest boundary,) and 6½ miles north of Chunian; and also at Chunian; and since 1870, a third register has been kept at Bhambeh, a station on the Bari Doab Canal, in a position very similar to Chunian, but 13 miles to the north-east of the forest boundary, and 19 miles north-east from Changa Manga or Vahn.

The rainfall chart of the Punjab shows that, in this part of the province, there is a steady increase of rainfall in a north-east direction, or from Chunian to Bhambeh; steady, that is to say, apart from the influence of purely local conditions; and, therefore, were the whole surface of the tract such as it is immediately around Chunian and Bhambeh, it might be anticipated that the mean rainfall of any intermediate station should be intermediate between those of Chunian and Bhambeh, in inverse proportion to their respective distances. The mean rainfall of Bhambeh, deduced from 17 years' registers, is 17·27 inches; that of Chunian, deduced from the same period, is 14·05 inches. If then Vahn, which is 19 miles from the former and 6½ miles from the latter station, had a rainfall intermediate between the above amounts, in inverse proportion to the distances of the two stations, the average of the same 17 years would be 14·85 inches. It is actually 15·76 inches, or nearly 1 inch above, the computed proportion.

I am far from considering this result as conclusive on the point at issue. In some years, the deviation from the mean proportions is very large; and on the average of the last three years, which, in this part of the Punjab, have been characterized with a remarkably low rainfall, the Vahn rainfall has been almost exactly in the inverse ratio of the relative distances of the two outer stations. Still, the evidence, so far, favours the idea, that the forest increases the rainfall.

The general conclusion to be drawn from the facts set forth in the foregoing pages is that, while no instance cited fulfils the requirements of scientific proof, the tendency of the evidence they afford is uniformly favourable to the idea that the presence of forest increases the rainfall.

The evidence is of three kinds. First, we have that of a large province, some five-sixths of which have always been a forest wilderness; but in which, for the first 10 years of the period of registration, the forest growth was greatly devastated, partly by *dáhya* cultivation, which completely destroyed the forest for the time

being, wherever it was carried on; and partly by annual forest fires, which destroyed the undergrowth and injured the larger trees. For the next 10 years, these destructive operations were suppressed, and the visible result is a forest growth, of such vigour and luxuriance, as to attract the attention of the Inspector General, when on his tour of inspection, to the question of its probable effect on the rainfall. During these last 10 years, the rainfall of the province has progressively increased, until it would appear to amount to 20 per cent. more than the average of the first 10 years.

The second instance is that of two pairs of comparative observatories, established on the Ebermeyer plan, in near proximity to each other, on the boundary of a protected forest; one of each pair being within, the other without the forest on open ground. Notwithstanding their proximity, in most months, the outer observatories show a slight excess over the inner. At each observatory there are two gauges, one at 60 feet above the ground, the other on the ground; and both afford consistent results. In the case of one pair of observatories, the total of 18 months' registers shows an excess in the inner high-level gauge of 4 per cent., in the lower of 2 per cent. In the case of the other pair, the registers of 12 months only show an inappreciable net difference of the totals, although in most months the forest gauges show a slightly enhanced fall.

Lastly, we have the case of a forest, artificially produced by irrigation, (during the two driest months of the year,) in a region, so dry, that cultivation is rendered possible only by irrigation. Seventeen years' registers, at a station within the forest, show an excess of 6 per cent. over the probable rainfall of that station, as computed from the registers of two stations, one of which is 4 miles, the other 13 miles, distant from the forest, and both on the borders of the cultivation.

The evidence is then, in kind, not rigorously conclusive; and it must be admitted that in no case has it been guarded by those special precautions which are demanded by strict scientific enquiry. B[illegible] I have no reason to believe that it is not as trustworthy as observations made under the general supervision of intelligent and educated men usually are; and such as it is, it tends to support and confirm the conclusions drawn *à priori* from general physical considerations. It justifies, I think, at least, the view I have already expressed elsewhere, *viz.*, that I can no longer regard the long suspected influence of forests on rainfall as a question of equally balanced probabilities.

FAIRY-RINGS.—A mushroom spore may be supposed to start its growth in or beneath the dung of cattle, or a bird, on poor soil; the first crop of mushrooms, produced from the mycelium to which the spore gave rise, exhausts the soil of available carbon, nitrogen, phosphorus, potash and other substances, storing all it can get in its own substance.

The mycelium extends centrifugally "into fresh fields and pastures new," and the next crop of mushrooms arises at a distance from the centre; and so the growth proceeds. The grasses, among the roots of which this extension is going on, now avail themselves of the rich manure afforded by the decomposition of the older mycelium, and a struggle for existence is set up which results in the victory of the coarsest and rankest-growing species. These in their turn exhaust the available supply, and if cut it is removed in their substance: no wonder, then, that the inner parts of the area are poor, and support little or no herbage.

A fungus-spore starts its mycelium among the roots of the grasses, and the hyphæ obtain a hold on some root-hairs and fibrils; the mycelium thus parasitic on the roots reacts in a stimulating manner on the latter, and we have a symbiotic relationship established between the fungus and the host. The consequence is that both flourish, and become rampant. It may be that only some grasses are thus stimulated, or even attacked, and this will affect their struggle for existence, and result in the selection of a few coarse forms. In time the hyphæ or the roots get the upper hand, and this is expressed in the survival of the grass, or its decay; in some cases it is clear that hyphæ are living at the expense of dead and dying roots.—*Nature.*

THE

# INDIAN FORESTER.

Vol. XIV.] February, 1888. [No. 2.

## A FOREST TOUR AMONG THE DUNES OF GASCONY.

*(Concluded from page 10).*

### TREATMENT OF THE CLUSTER PINE.

ON our way from Bordeaux to Arcachon, we left the train at La Teste, and walked across the dunes to our hotel. The forest which consists of pine, unmixed with other species, is felled, in some blocks at 60 years, and in others at 72 years of age; but oaks (*Q. pedunculata* and *Q. Toza*) are now being planted among the pines.

After breakfast, we visited the Mouleau block, situated at a distance of three or four miles, in a southerly direction, from Arcachon. Here we found that, as elsewhere, the forest had been naturally regenerated with great success, there being a dense crop of young trees, 10 years old, and from 15 to 20 feet high, upon the ground. M. Boppe explained the system of treatment adopted for the cluster pine forests of this region. The tree has special requirements in the way of soil and climate; it will not grow upon limestone, and cannot stand cold, down to one or two degrees above zero (Fahrenheit), if prolonged for more than a week; neither can it be grown profitably for resin, at any great distance from the sea. It is most important, in the case of this, as of other species, that, before the tree is introduced into any locality, a careful study should be made, in order to decide whether the conditions are such as will ensure success; and a forcible argument against the use of new species in extensive afforestation works is, that these conditions may not be fully known at the time. For instance, the cluster pine was largely planted in the Sologne and in Normandy

between the years 1830 and 1880; but during the unusually cold winter of 1879-80, nearly the whole of these forests, covering in the Sologne alone an area of over 300 square miles, were completely killed off.

The cluster pine seeds abundantly nearly every year, and its regeneration by natural means is easy to effect. As we had previously noticed in the Maures, we found that, wherever a seed-felling had been made, there was almost invariably a plentiful crop of seedlings on the ground; so that, if these could be protected against fires and grazing, the remainder of the trees might be removed, without fear of failure to obtain a fully stocked forest. The pine has long thin needles, giving very light shade, and the trees will not stand being grown close together; those only which are sufficiently far apart, vigorous, and have a well-developed crown yield resin in large quantities. Thinnings are commenced when the young trees are from 6 to 8 years old, and are repeated every 5 or 6 years. When the forest is 20 years of age, there should be from 250 to 280 stems per acre; but at 30 years, not more than from 100 to 120 of these should remain, the number being finally reduced to from 60 to 80, when, at the age of 70 or 80 years, regeneration fellings are commenced. With this number on the ground, the upper or cone-bearing branches are free, but not the lower ones; these latter should be allowed to touch, so that the natural pruning of the lowest of them may be effected. *In order that the extraction of resin may be successfully* carried on, it is necessary that the trees should have clean stems, free of dead branches, up to a height of some 16 feet; and to ensure this it is usual, as an additional precaution, to prune away the lower branches, at the time that the first thinnings are made, that is, when the forest is not more than from 6 to 8 years old; but this has to be done carefully, avoiding the removal of too many leaves at a time, as otherwise the growth of the young trees would be checked.

The light cover of the pine does not afford sufficient shade to keep down the undergrowth of grass, gorse, heather, broom, ferns, and other plants, which spring up in dense masses as the thinnings progress. These shrubs and herbs are much valued for litter and manure; and it is customary to export them, with the dead pine leaves, for these uses. This of course prevents the accumulation of vegetable mould; but it is said that the practice is useful to some extent, in that, when they have been removed, the resin collectors can move about the forest freely, and the risk from fires is diminished. It would, however, be much more advantageous if an

undergrowth of oak (*Q. pedunculata*) could be established instead of these shrubs. M. Boppe suggested that oaks should be planted when the pines are 10 or 12 years old, at which age they have usually suppressed the shrubs that grow up with them; but M. de Monteil would prefer to put them in at the time of the seed-felling, and keep them from being choked by clearing round them. However this point may be decided, the introduction of the oak beneath the pine could not fail to be of great value as a protection to the soil.

The enemies of the forests are our old acquaintances the graziers and the fires; the former, mounted on their tall stilts, driving their flocks wherever grass is to be found,—that is to say, where the young seedlings are growing. It is said that article 67 of the Forest Code (which provides that grazing rights can only be exercised in those blocks which are declared out of danger by the Forest Department) cannot be brought into force here, which seems a great pity. Fires cause very great damage; for, not only is the undergrowth of shrubs, and the mass of dead leaves and needles on the ground, extremely inflammable, but the pine trees themselves are so also. Conflagrations are sometimes caused intentionally by the shepherds, who desire to extend the area of their grazing grounds; but they are also frequently due to accidents, and it is said that they are sometimes caused by sparks from railway engines. When they occur, they are most destructive in their effects. In passing along the railway, at a distance of a few miles from Arcachon, we saw a large tract which was completely bare, the entire forest having been burnt off it. Unfortunately, there is no special legislation here, such as exists in the Maures and Esterel; and nothing can be done but to cut fire-lines from 30 to 70 feet wide, round, and at regular intervals through, the forest, so as to divide it into blocks of 250 acres each. These lines serve as roads, and as starting points for the counter-fires, which are lighted, when occasion requires it, in order to prevent the spreading of the flames. On each side of the fire-lines, as well as a along the main roads and railways, the undergrowth is carefully burnt off, so as to diminish the chance of accidents; and, every third year, the lines themselves are dug up, and all roots are extracted. This work, which is usually performed by women, whom we saw using a tool something like a large Indian hoe, costs about 5*s.* per acre of fire-line. The trees are sometimes attacked by a species of fungus; and it is customary to dig trenches round those which show signs of this malady, in order to prevent its spreading further.

While we were inspecting the old portion of the forest of La Teste, near Arcachon, to which allusion has previously been made, the Professor explained to us that resin is extracted from the trees, either in large quantities, so as to kill them in four or five years *(Gemmage à mort* = Tapping to death), or in comparatively small quantities, so as not to cause their death *(Gemmage à vie)*. The first of these methods is adopted in all thinnings of trees aged 25 years and upwards, and also in the seed-felling as well as in the final felling. The operation is commenced five years before the trees are to be cut down, and is continued for four years, the trees being removed during the fifth year. The aim is to take all the resin that the tree can give, leaving it exhausted at the end of the fourth year; and to effect this, many cuts or wounds are made at the same time, their number depending on the size of the tree. Sometimes there are three or four; but, in the case of large trees, there may be as many as ten or a dozen, and sometimes even more. One result of this treatment is to cause an abundant growth of seed; and this fact has great importance when the last representatives of the crop are about to be removed, for it ensures the springing up of a full crop of seedlings. The effect is similar to that produced on fruit trees, by injuries inflicted on the branches, roots, or bark, with a view to obtain an increased crop of fruit. Trees which show signs of failing from any cause, commence to produce their successors.

The second method, under which the life of the tree is to be preserved, is practised only on those which have been selected to form part of the final crop *(arbres de place)*. They are not tapped until they have a girth of from 44 to 48 inches, which is usually attained when they are from 30 to 40 years old; it is considered risky to take resin from them at a younger age. At first, only one cut is opened, and it continues to run for five years, when another, on the opposite side of the tree, is commenced. Then, half way between these two, a third and a fourth cut are opened in succession, and so on; if two cuts are opened at the same time, they should be at different levels, but the number should never exceed two.

The above is the improved system now in vogue. But in former years it was not the custom to tap trees to death, and the forest we visited was particularly interesting, as enabling us to see what the effects of the old practice were. Here we saw some trees of great age, showing as many as thirty-six wounds, and doubtless there were many more, the traces of which we could not detect. Such trees are probably at least from 150 to 200 years

old. They present a most remarkable appearance; the lower 15 feet of the stem being swelled out into a sort of bottle-shape, and consisting, in some instances, of vertically detached fragments, through the interstices of which, light, entering on the opposite side of the tree, can be perceived. This bundle of sticks looks as if it would give way under the burden of the mighty crown which it contrives to support. M. Boppe had, however, something more important than this to call our attention to, *viz.*, the *effect on the forest* of this method of treatment, which, of course, since the tapping of every tree is continued until it dies, at a more or less advanced age, is almost exactly analagous to the selection method *(jardinage)*. Here then was an excellent opportunity to observe the effects of this manner of treating a species, which, like the cluster pine, has light cover. We certainly saw a number of trees of all ages and sizes, some of them from 90 to 100 feet high, and 12 to 13 feet in girth; but the ground was extremely badly stocked, much of it being completely bare. When a high forest is stocked with species of heavy cover, it is easy to keep trees of all ages growing together, for the shade of the taller ones does not interfere with the healthy growth of those standing below them. But in the case of trees of light cover, it is impossible to maintain, by this system, anything but an extremely thin crop, for the young trees cannot live under the shade of the older ones. For such species, the regular system, with the age-classes grouped together, is the only one that can be successfully employed.

On our way from Arcachon to Labouheyre, we passed through some private forests, in which we saw a large number of kilns in which pine wood was being burnt into charcoal; and we also inspected some ground which had, four years ago, been sown with a mixture of pine and broom, in lines 5 feet apart. The young crop appeared to be in a flourishing condition. Near the forest house, we saw some plantations of cork oak *(Q. occidentalis)* and also of *Quercus pedunculata*. Some tea seed had been sown as an experiment, but there does not appear to be much chance of its succeeding.

### TAPPING FOR RESIN.

The cluster pine has large and abundant resin canals, the contents of which circulate much more freely in the sap-wood than in the heart-wood. In order to tap the tree, a cut, commenced near its base, is carried gradually upwards, to a height of about 12½ feet, but more rarely to 15 or 16 feet, and the resin, flowing

therefrom, is collected in pots and removed to the factory. This operation will now be described more in detail. Towards the latter end of February, the dry outer bark is removed, by means of a special tool *(barrasquite)*, from the place where the cut is to

be made, up to a point some 4 inches higher than it will extend during the coming season. The bark is taken off a surface wider by about 1 inch than the cut is to be, the object being, not only to prevent fragments of falling bark from becoming mixed with the resin, but also to save the sharp edge of the tool with which the cut is subsequently to be made and renewed. Early in March, the tree is again visited, and a wound of concave shape, about 4 inches wide, 2 or 3 inches high, and less than $\frac{4}{10}$-inch deep, is made in the sap wood, near the ground, with a peculiarly-shaped axe *(abchotte)*. Below this, a small curved zinc plate is driven into the bark; this acts as a lip, to guide the flowing resin into the earthen pot placed below it. The wound runs freely

for from five to eight days, when the upper portion of it is renewed, by taking off a thin chip with the *abchotte*, and it is thus slightly heightened. This operation is repeated some forty times during the season, which extends to the 15th October, and, by this time, the cut has attained a height of 22 inches. The semi-solid resin (gallipot), of which the quantity is very small under this system, is scraped off, by the hand of the workman, from time to time; and, at the close of the season, the more hardened resin *(barras)* is removed with the *barrasquite*, and carried to the reservoir. At the beginning of the second season, the bark having been removed as before, the zinc plate is driven in at the top of the old wound, and the pot, supported below by a nail driven into the tree, is placed immediately under it. The collection is then continued; but when there are irregularities in the stem, or when it does not stand perpendicularly, chips of wood, driven into the bark, and ingeniously arranged, guide the resin in the desired direction. The cut is increased in height by 30 inches during the second year's work, and by a similar amount during each of the third and fourth years; but during the fifth and last year the height is increased by 40 inches. The cut having now attained a total height of 12 feet 8 inches, is abandoned, and a new one is commenced. When the tree is to be "tapped to death," the cut is made to attain its total height in four instead of in five years. The pot, which is sometimes closed with a little wooden cover, so as to reduce evaporation, is, when full, emptied into a wooden bucket, in which the resin is carried to a reservoir in the forest, whence it is subsequently conveyed to the factory in barrels, each holding 520 lbs. When the cut has risen in height, so that the workman, standing on the ground, cannot reach it with the *abchotte*, he provides himself with a sort of ladder, consisting of a notched pine pole, 15 feet long, which he places against the tree, and on which he mounts to the required height. When the pot is too high to be reached from the ground, it is removed by means of a sliding staff, which can be extended to a length of 11 feet, and is furnished with a pair of metal arms to grasp the pot; but sometimes a sharp, broad-bladed, hook-like tool, something like the *barrasquite*, is fixed to the sliding staff, in addition to the metal arms, and, with the aid of this instrument, the cuts are renewed by the workman, while standing on the ground, without his being obliged to carry and mount a ladder. The method above described, which bears the name of its originator, M. Hughes, was explained to us in detail, the whole operation being carried out in our presence. It has this great advantage, that the resin is not mixed

with any large amount of foreign substances, and that, as it runs down the length of a single year's cut only, the loss by evaporation is less than formerly, when it was collected in a hole at the foot of the tree. The collection, which is usually done by contract, can also be much better carried out and supervised under the new method. It is said that a man and his wife can look after from 2,500 to 3,000 trees a year.

It is very difficult to give figures accurately representing the annual yield of these forests in crude resin; but the amount is put down at from 200 to 400 lbs. per acre, the price obtained at the factory being from 14*s*. 6*d*. to 16*s*. 6*d*. per 100 lbs. It is also stated that a tree, tapped so as not to cause its death, yields, annually, from 6½ to 10 lbs. of resin, a very large one having been known to give about 16 lbs. Some figures relating to last season's sales, in the Gartey and Pilat blocks of the forest of La Teste, may prove of interest. The right to tap and fell, within five years, 7,528 trees, aged from 60 to 80 years, and constituting the final felling on an area of 118 acres, was sold for £1,592. This gives nearly £13 10*s*. per acre, and a little more than 4*s*. 2*d*. per tree. The yield was estimated to be 245,055 cubic feet of timber, 125,158 cubic feet (stacked) of firewood, and 2,082 cwts. of crude turpentine. It must not be forgotten that the above is the revenue for the last five years only; previously to this, thinnings have been disposed of, and the trees now sold have been tapped since they were about 30 years old.

### Manufacture of Resin.

When travelling from Bordeaux to Arcachon, we left the railway at La Teste, to visit a resin factory close to the station.

The crude resin, brought to the factory in casks, is, notwithstanding the precautions taken, found to be mixed with a certain quantity of foreign substances, such as earth, chips, bark, leaves, insects, &c. After adding about 20 per cent. of solidified resin (*barras*), scraped from the cuts, it is heated moderately in an open caldron, so as to bring it into a liquid state, when the heavier impurities sink to the bottom, and the lighter ones rise to the surface. The liquified resin, thus obtained, consists of two distinct substances, *viz*., colophany, which is solid at the ordinary temperature of the air, and spirit of turpentine, which is liquid and volatile, and some of which is lost if the caldron is over-heated. These two substances are separated by distillation in the following manner:—The liquid resin is allowed to run through a strainer into a retort, a small quantity of water being introduced at the same time. The

rising steam carries the spirit of turpentine with it, and both are, after passing through a refrigerator, caught, in a liquid form, in a trough placed to receive them; the spirit, being lighter than the water, lies over it, and is easily drawn off. The colophany is then allowed to run out of the retort, and passing through a sieve, is caught in a vat below. Thence it is poured into flat metal dishes, and allowed to harden in the sun, under which process the finer qualities acquire a delicate amber colour. There are several classes of this substance, distinguished chiefly by their colour, which is a guide to their degree of purity, and these are known by various names, and have different commercial values. The impure residue left in the caldron is distilled separately, and yields rosin and pitch. The raw resin, collected from the trees in the autumn, is harder and less valuable than that obtained during the spring and summer.

We were told that, at this factory, 25 barrels (each containing 520 lbs.) of raw resin are distilled per diem in summer, and 16 in winter. The spirit of turpentine sells for 24*s.* per 100 lbs., and the colophany for 9*s.* per 100 lbs.; but the purer kinds, for the manufacture of which only the most liquid portions of the raw resin are put into the caldron, fetch from 13*s.* 6*d.* to 14*s.* 6*d.*, the price of the finest quality, known as Venice turpentine, rising to £4 10*s.* per 100 lbs. Comparatively small quantities only of the finer substances are manufactured.

### Utilisation of the Wood and Substances extracted from it.

The effect of tapping the pine is to cause a flow of resin towards the lower portion of the stem, which thus becomes charged with that substance, and is rendered harder and more durable than the upper part of the tree. The resinous wood is used for various purposes: very largely for railway sleepers, when it is injected with creosote or sulphate of copper. We visited a factory at Labouheyre, in which the latter substance is used for injecting sleepers and telegraph posts; and the superintendent assured us that, for pine wood, it is much superior to creosote. We saw many thousands of injected pine sleepers at this and other railway stations, and were informed that they are largely employed on the lines. Planks and scantlings, of which a large stock was lying at Labouheyre, are sent for sale to Paris; while poles, extracted during thinnings, are used as telegraph posts and mine-props. Last year, when we were in the Cevennes, we found that mine-props from the Landes were employed there. Charcoal is also made in some forests.

On our way from Labouheyre to St. Eulalie, we visited an establishment for the manufacture of pinoleum, or pine-oil, which is used as a preservative for wood, and also, when prepared in a special manner, for burning in lamps, as a substitute for kerosine. The machinery was not working, and we were unable to study the details of the system; but the light given by the oil, which is used to a considerable extent in that part of the country, and possesses the great advantage of not being explosive, is very good.

## CHAPTER II.

### FORESTS ON THE ADOUR, NEAR DAX.

The morning after our arrival at Dax, M. Delassasseyne, the Inspector, and M. Tellier, *Garde-Général*, took us to see some cork-oaks, which are grown, at a short distance from the town, like apple trees in an English orchard. *Quercus occidentalis* is almost identical in appearance with the cork trees we saw in Provence; but its fruit ripens in two years, instead of one, as is the case with *Q. Suber*. The trees, which stand isolated from one another, and are much branched at about 7 feet from the ground, are visited once in every 8 to 14 years, when the cork is removed from the entire stem; an average sized tree then yields about 22 square feet of cork sheets, which represent a net revenue of about ten-pence a year. It is said that where *Q. occidentalis* occurs mixed with *Pinus Pinaster*, it has a tendency to drive the latter out of the field.

We spent the afternoon in inspecting the communal oak *(Q. pedunculata)* forests of Tilhieu, situated on the right bank of the Adour, a few miles above Dax; they are inundated, two or three times a year, to a depth of 12 or 14 feet, or even more. The part of the forest that we entered first consists of oak unmixed with other species. The trees are 40 years old, and about 50 feet high; they are to be felled at the age of 120 years. We remarked at once that they had an unhealthy appearance. They were much branched, and had crooked stems, covered with twigs *(branches gourmandes)* and lichen up to "high-water mark." Many of the larger branches were dead, while the stems were, in numerous instances, split by the action of frost; and it was evident that they required the protection of a lower stage of forest growth, which would remedy many of the existing defects. There were no seedlings on the ground, which was covered, in places, with ferns, brambles, a little gorse, and "butchers' broom" *(Ruscus aculeatus)*. The forest is heavily grazed over by cows and bullocks,

which, however, do comparatively little harm, because the inundations, which leave a deposit of fresh soil behind them, prevent the ground from becoming hardened by the animals' feet. M. Boppe remarked that natural regeneration is here very easy to obtain, for the oak gives seed every year, a plentiful crop occurring every second year; and the soil being extremely fertile, growth is rapid. But the old difficulty of treating a species of light cover as a pure forest has to be encountered; if the trees stand too thickly together, they grow up tall and thin, and many branches die; while, if heavy thinnings are made, after considerable intervals of time, there is a large development of twigs on the stems. The treatment of such a forest is a very delicate operation, requiring much skill; and the only way to achieve success, is to make light thinnings frequently. If this be not done, the forest will, in all probability, be ruined. If it were possible to introduce a mixture of hornbeam, which, unfortunately, does not succeed here, this tree would serve to protect both the ground and the stems of the oaks, without interfering with their crowns; and heavier thinnings, which would have a very favourable effect, could then be made. There are no harmful insects in this forest, probably owing to the periodical inundation of the ground.

Passing on, we traversed a younger portion of forest, where the oak is mixed with a few elms and maples *(Acer campestris)*; and, leaving this, we entered a block in which the final fellings had been made from two to five years previously. Here the rapid growth of the young trees was very remarkable, those five years old having a height of 6 or 7 feet. The ground was densely covered, not only by young oaks, but also by a mass of tangled shrubs and brambles, which spring up immediately after the final felling has been made; through these, the young oaks manage to force their way in two years, and, ultimately, they suppress them entirely. In this climate, oaks are not injured nor checked by spring frosts, which occur so frequently, and do so much damage, further north.

We now entered the oldest part of the forest, aged from 120 to 150 years, which has been subjected to uncontrolled selection fellings, and has, at the same time, been grazed over, chiefly by pigs and geese, which eat enormous quantities of acorns, as well as by other animals. Consequently, instead of finding trees of all ages on the ground, we saw a somewhat thin crop of old trees of great girth, which are branched and heavy topped without being tall, and are covered, in many instances, with climbing ferns, of, apparently, one of the species commonly found on the lower

slopes of the north-western Himalaya. Under these large trees, are seen dense thickets of bushes, between which the animals graze; there are also a few young oaks, of stunted and unhealthy appearance, but not completely killed out by the cover, as they probably would have been, under similar circumstances, in a more northerly latitude. For here the light is more intense, and they are, on this account, enabled to maintain themselves under cover of the larger trees; but they cannot grow up, so that they do little or nothing towards the establishment of a regular gradation of age-classes. In fact the selection method cannot be successfully applied in the case of a pure forest composed of species of light cover, even when there is no grazing; but when, as in this instance, animals are freely admitted, the system fails completely. If this portion of the forest were now to be merely closed against grazing a large increase in the number of stunted young oaks would undoubtedly follow; and some of these would push their way upwards, in the more open places, but there would never be a properly constituted crop of sound and well-shaped trees of all ages on the ground.

But, fortunately, an effective remedy for this state of things can easily be applied. In order to get a complete crop of young seedlings, grazing must be entirely stopped, and the dense undergrowth of shrubs must be cleared. This latter process is found to act like a seed-felling, as it results in a marvellously dense growth of seedlings, which, a year or two after the bushes have been cut down, are sufficiently established to permit of the old crop being removed; and the forest is then completely regenerated.

We subsequently passed through parts of the forest where no grazing had been permitted for the last 8 or 10 years; but the bushes had not been cut away, neither had the old trees been removed. Here we saw a splendid crop of young seedlings in the more open places, and a quantity of suppressed growth among the bushes; all that was wanted was to complete the operation in the manner described. When this has been done, the seedlings and bush-coppice will grow up together; but, as has been previously mentioned, the oaks will soon push their way through the latter, and ultimately kill it out. There are here about 7,500 acres of this sort of forest, all of which will, in due course, be subjected to the kind of treatment above indicated.

We returned home through a block which is heavily grazed over, but contains some magnificent old trees of the most picturesque appearance, the effect being equal to the most beautiful parts of Fontainebleau.

## CHAPTER III.

### TORRENTS NEAR BARREGES IN THE PYRENEES.

From Dax, we travelled by rail to Pau, where we spent a few hours, and visited the splendid public gardens, which contain beech trees almost as tall as those at Villars-Cotterets. Thence we went by Tarbes and Lourdes, and on a branch line running up one of the valleys of the Pyrenees, to the terminus, which is on one of the roads passing through the mountains into Spain. Some picturesque but dirty Spanish peasants, homeward bound, were among those who left the station with us at Pierrefitte, whence we drove to Barrèges.

The drive was lovely; the snow-capped granite peaks overlook the stream, which has cut its way into the schist, and runs in its narrow bed between almost perpendicular sides, often of great depth. Barrèges, which is at an altitude of 4,200 feet, is a sanitarium for soldiers, its baths having the reputation of being peculiarly efficacious in the healing of wounds.

After breakfast, we started to inspect the torrent of Rioulet, on the left side of the valley. The hills are here, generally speaking, composed of firm strata, not liable to be washed down, and thus to cause disasters so serious as those which occur in the Southern Alps. But large avalanches are of frequent occurrence, and occasion much loss of life and property. At a short distance above Barrèges, our attention was called to a large mass of snow, which, during the month of April last, fell into the valley, and completely blocked it up. On the opposite side, works are in progress, with a view to clothe with forest the hill-sides above the cultivation and villages, and by this means to reduce the danger from avalanches.

We were now in a communal beech forest, which has a thin crop of old trees, with very good naturally-sown young growth on the ground; but there were many windfalls. We entered a nursery, where young beech trees are raised for filling up places in which the young crop is incomplete; and we then descended to inspect the large weir *(barrage)*, which forms part of a system of works constructed in order to reduce the slope of the torrent bed.

On one side of the main valley, the strata are exceptionally loose, and the water, cutting its way into them, causes the sides to fall in; thus, not only is an ever-increasing area of the hill-sides themselves ruined, but much damage is done in the lower part of the valley by the rush of water, and the deposit of silt carried down by it. This is an example, on a small scale, of what occurs, with such disastrous results, in the Southern Alps. The system

adopted for the treatment of this evil may be briefly described as consisting of a series of obstacles, erected in the bottom of the ravine, and behind which the rocks, gravel, and mud, brought down by the water, are retained. The slope of the bed being thus reduced, while, at the same time, it is raised, and consequently widened, by these deposits, the unstable sides receive support; and when they have been sufficiently consolidated, they are planted up. In this manner, the forces of nature are directed and employed by man, to restore the damage they caused when uncontrolled; much in the same way as they are in the treatment of the dunes, described a few pages back. The weir we inspected is constructed of masonry, and has a total height of 65 feet, including 20 feet of foundations. It is one of those made when works of this nature were undertaken for the first time in 1862; and it was in the nature of an experiment. It is now seen that its design is faulty in many ways, and it cannot be taken as a model of what such constructions should be.*

On ascending to a higher level, we looked across the main valley, and noticed a good many torrents, in process of formation, on the opposite side, a mile or so below Barrèges. The general appearance of the country led us to suppose that the bottom of the main valley was once filled by a glacial bed, through which the present stream has forced its way; and the secondary torrents, now cutting through the unstable sides, must be dealt with at once, before they go too far. It is the intention of the Government to buy the land with this object. We next entered a plantation of *Pin à crochet* (*Pinus montana*, Miller) and *Pin noir* (*Pinus Laricio*, Poir), planted in clumps. Many of these are dying off, and M. Luze, the Inspector who accompanied us, feels considerable anxiety regarding their future. It seems probable that the trees, having got into an unhealthy condition, have been attacked by a fungus, and, subsequently, by the insects which we found in many of those we examined. With regard to the system of planting in clumps, it is said that the plants impede one another's growth, and that it is much better to put them in singly. These plantations extend up to an altitude of 7,250 feet, larch being used above 6,500 feet. The plants are grown in temporary nurseries, which alone are suitable for mountainous regions, not only on account of the difficulty of carrying the plants over long distances, but also because the young seedlings should always be grown at the same level, and as

* On a future occasion the writer hopes to give a more complete account of the works undertaken in the Southern Alps, which are much more extensive and interesting than those near Barrèges.

nearly as possible under the same conditions in which they will find themselves when they have been put out. Before turning homewards, we had an excellent view of the snow-capped peaks, including the Pic du Midi de Bigorre (9,440 feet), which was close to us.

We returned home by the valley of the Pontif torrent, which is in a bad state, but has not yet been taken in hand. This gave us an excellent opportunity of studying the condition in which these torrents are found, before works to regulate them have been undertaken.

Returning next day to Toulouse, we noticed that the lower spurs of the Pyrenees, which are well wooded, are, generally speaking, covered with a simple coppice of beech, cut in vertical strips. This tends to the formation of torrent beds, which indeed appeared *to be commencing in many places.* Thence we travelled direct to Nancy, where we arrived on the 6th of May.

# SOME FACTS REGARDING THE PRODUCTION OF RESINS AND TURPENTINES IN INDIA.

SINCE 1881 the question of creating a demand in England for Indian *resins and turpentines has been before the Government of* India, and in this connection some valuable preliminary information has been collected, which we will attempt to bring to a focus here.

Of all our conifers those which are likely to yield resin in sufficiently rèmunerative quantity are *Pinus Khasya*, *Merkusii* and *longifolia*, and perhaps also *P. excelsa*.

### *Pinus Khasya.*

The resin of the Khasya pine is believed to be the most valuable in India, and has attracted the special attention of Sir Joseph Hooker. Forests of this tree are estimated to cover about 270 square miles, of which 230 are in Assam, the remainder being in Burma. Of the area comprised in Assam, only 33 square miles are at the disposal of Government, the rest being in private hands and regularly subject to jhooming, and, therefore, mostly too young at present to be in a condition to yield. The small area in Burma can, however, it is confidently believed, be largely extended and improved, nothing but fire-conservancy being required to transform the hill sides into pure pine forests. But the pine localities are in both provinces far removed from markets, and are

so little accessible, that the cost of 100 lbs. of crude turpentine delivered at Calcutta and Moulmein would, under present conditions, be Rs. 32 and 36 respectively.

In Assam the resin is collected in an impure state from cuts made in trees, and also in a clean condition by heating chips of thickly resin-impregnated wood in inverted earthen pots, and receiving the liquid resin that runs out into smaller pots placed below. For this latter process the wood of standing trees is made abnormally resinous by cutting a long blaze into the trunk about 1 foot wide and 4 feet long, the trees being cut down for use at the end of 12 months. A good deal of resin exudes from the blaze, and this constant outflow of resin in one direction excites an unusually copious secretion of it in the trunk, the wood cells of which thus become thickly encrusted with it. The resin that runs out is not allowed to go to waste, but is collected in a sort of hollow-bottomed niche cut into the trunk at the lower extremity of the blaze. Mr. Mann estimates that under the system just described a full grown tree will yield 68 lbs. of crude resin. The resin-encrusted wood of trees so treated contains 16 per cent. of its total weight of crude resin. Chips of this wood are regularly sold in the Shillong bazar for the purpose of lighting fires. It is obvious that only trees of a certain size can be so treated with any profit, their minimum age being estimated by Mr. Mann at 50 years.

In Burma the Khasya pine is never tapped for resin. The wood is used for torches by the villagers in the neighbourhood of the pine forests.

Professor Armstrong, F.R.S., Secretary of the Chemical Society, who has made an especial study of resins and oleo-resins, wrote as follows in 1881, regarding the crude turpentine of this pine :—

"It consists of a sold resin similar to colophony, and of a liquid 'turpentine oil.' The latter is remarkably pure and free from smell, and ought, I should say, to be very valuable for purposes for which the French and American oils are used. * * * Neither French nor American oil, especially the latter, are homogeneous, but this *Pinus Khasyana* oil, so far as I can judge from the examination of the small quantity at my command, is almost a pure substance."

A barrelfull of the crude resin was depatched to Professor Armstrong in 1881, after he wrote the above note ; but no further communication has yet been received from him.

### *Pinus Merkusii.*

This pine is found only in Burma, where it covers about 50

square miles in the Thaungyin valley in the Tenasserim Circle. These forests are much more accessible than the Khasya pine tracts, and no difficulty is anticipated in extending them by the reservation of suitable tracts, as the population there is sparse, and the tree can be easily propagated. The cost of the Merkusii resin delivered at Moulmein is the same as that of the Khasya resin, but will be much reduced as soon as the valley is opened up to cart traffic. The few experiments hitherto made seem to show that a tree of 6 feet girth can yield 12 lbs. during the first year in which it is tapped.

### *Pinus longifolia.*

The aggregate area under this pine is very large, and is comprised in the outer Himalayan belt, varying from 20 to 40 miles in width, from Nepál to the north-west frontier. No very approximate figure can be given for the total area lying inside British territory, but it certainly exceeds 2,000 square miles, distributed as follows :—

| | Square miles. |
|---|---|
| Kumaun and Garhwal (Sarda to Ganges), ... | 1,000 |
| Jaonsar (Ganges to Tons), ... ... ... | 300 |
| The Punjab, ... ... ... ... not less than | 1,000 |

of which only about 500 are at present workable.

Some information regarding the native method of tapping, yield, distillation, &c., is given in Vol. IX. of the "Indian Forester."

The system employed by the hill-men in Kumaun and Garhwal is to cut a sort of niche into the trunk about 3 feet from the ground. The bottom of the niche is hollowed out to receive the resin that trickles down its sides. The resin is collected as the niche fills, sometimes as often as every second or third day, but usually between the fourth or fifth day. The niche has to be deepened and lengthened from time to time, so as to freshen the wound and keep up the outflow of resin ; otherwise the old resin would harden on the sides and form an impenetrable crust through which no new resin could ooze out. The same niche is, as a rule, used for two years, and sometimes even for three, when no fires occur in the meanwhile to burn and scorch the resin-incrusted sides. The new sapwood is the main reservoir of resin, and in all tapping operations it is the sapwood that must be cut into. The season for tapping begins in February and ends in June, when the trees are again actively transpiring through their leaves and the secretion of resin diminishes. The process of collection could be continued

almost to the end of autumn, if rain could be prevented from getting into the niche, but the yield would be insignificant, and would not pay the trouble of collection. A high temperature and very dry weather combined are unfavourable for the outflow of resin. The yield per tree is very variable. Mr. Richard Thompson (Brandis, p. 507) puts it down at from 10 to 12 lbs. during the whole process of tapping. At Naini Tal Mr. Fernandez was informed that from 4 to 6 lbs. are obtained the first year, and about half that the second year. The largest outflow takes place when the niche has just been scooped out, as much as 1 lb. being obtained at the very first collection from an average tree. The hill men seldom concern themselves about the life of the trees they tap, and they generally work three niches simultaneously in one and the same tree. Taking the forests all round, a maund collected even by the process just described could be delivered on the railway for about Rs. 3-8.

Twenty trees, of girths varying from 7 to 9 feet, were tapped, as an experimental measure, according to the native system in Jaonsár. The yield from the middle of March to the beginning of the monsoon, towards the end of June, was on an average 3¼ lbs. of crude resin per tree. The actual cost of collection and carriage to Deoban, 3 miles above the end of the cart road at Chakrata, was Rs. 4 per maund; but as the quantity collected was only 65 lbs., the cost under a properly organised system of work would be about 50 per cent. less, and a maund could be laid down on the railway at Sahárанpur for Rs. 3.

In the Punjab, trees were tapped as follows, in order to ascertain the yield, cost, &c. :—

*Hazára Division.*—430 trees, of girths varying from 4 to 13 feet, average 6 feet 4 inches. Tapping begun in May—June, and concluded July—August. Average yield of crude resin per tree = 3·8 lbs.

*Chamba Division.*—259 trees, of girths varying from 3½ to 6 feet, average about 4 feet. Tapping begun March—April, and continued, it is believed, till September. These trees were distributed amongst three separate places. The average yield per tree was respectively only 0·88, 1·95 and 0·62 lbs. respectively. The largest yield from a single tree was 2 lbs.

*Basháhr Division.*—150 trees on a northerly, and the same number on a westerly, aspect. Tapping carried on northerly aspect from 7th June to end of October, and on westerly aspect from 20th August to end of October. The average yield per tree on the two aspects was respectively 6·8 and 4·4 lbs.

blazes were cut deep into the wood, and were extended upwards from time to time.

The cost of collection, on account of the smaller yield, will always be relatively heavy as compared with the corresponding items in the case of *Pinus longifolia*.

*General conclusions.*

There can be no doubt that we possess very large resources, which only require proper development and exploitation. What is wanted is a sufficiently active demand to make the exploitation remunerative. But it would be a mistake to do nothing at all in the meantime, and wait until this demand arose before we began to explore our forests and ascertain the best methods of tapping and the conditions of soil, climate, locality and treatment that will give the largest and most profitable yield. All this preliminary work of enquiry and self-instruction must have been completed when we undertake to meet any demand that arises. For this purpose the workable areas in the various forest divisions should be explored and marked out on the map, and tapping experiments should be systematically carried out in some one place under competent and effective supervision. The best locality and agency for such experiments would be the School Circle of the N.-W. Provinces and Oudh in the case of *Pinus longifolia* and *excelsa*, and Assam and Burma, in communication with the staff of the Forest School, for *Pinus Khasya* and *Merkusii*. Through the kindness of Colonel Bailey, the Forest School has been supplied with a complete set of tools used in the French Landes, and a very good duplicate set has been made from these as models, and any number of such sets may be made by any ordinary smith. It is necessary that the collection of information should be centralised, for experience has proved that desultory efforts made here and there all over India never have any practical value. And it is obvious that the Forest School staff, composed of men whose whole time is devoted to the study and advancement of forestry in all its branches, and who are the most likely of all to preserve a continuity of ideas and principles of work, is the best agency to be entrusted with this centralised control.

In conclusion, we would draw attention to a mistaken belief held by many people that trees grown for timber cannot be tapped. The best cluster pine railway sleepers are those obtained from trees that have been tapped from an early age; as they are more heavily encrusted with resin, and, therefore, more durable. Even when boards, planks and battens are required, no injury is done to the tree if it is tapped to death just before being felled.

## CUTCH EXPORTS FROM UPPER BURMA.

I SEND you herewith a cutting from the "Rangoon Gazette" on the subject of cutch exports from Upper Burma, which may possibly be useful as 'padding' for the "Indian Forester." It is to us a matter of very great interest, as we get a considerable revenue from cutch in the Tharrawaddy and Promo Divisions. Thanks to the diminished imports from Upper Burma, and to the high rates which cutch is now realising, I anticipate getting in the Tharrawaddy Division some Rs. 50,000 during the present year, as compared with Rs. 20,000 last year. I have already realised some Rs. 35,000 during the first 4½ months of the year. I have long been intending to write to you on the subject of cutch, and the history of the growth of the revenue which is derived from it, but have not been able to do so. Last year the highest price realised *per cauldron* for working cutch inside reserves was Rs. 68, whilst this year we have obtained in some cases over Rs. 250 per cauldron.

THARRAWADDY, 
*21st August, 1887.* T. H. A.

---

"It would be a very great pity indeed if any portion of the export trade in Upper Burma were to decrease under British rule; yet apparently the cutch trade is doing so. The decline began some years ago, and has gone on steadily year by year. In 1883-84 the quantity exported *viâ* Allanmyo was very nearly 150,000 maunds; the following year it fell to 104,000 and in 1885-86 to 70,000. Of course this last named year was the year of the war, and a considerable decline was to be expected then; but during the next year, 1886-87, the country about Myingyan was fairly quiet—as quiet as it had been during the last two years of Theebaw's reign, and probably a good deal more so—yet in this year there was a further decline to 64,000 maunds. Thus in four years the export of this article has fallen to less than half. In the same period of time the exports *viâ* Tounghoo have fallen from 10,000 maunds to *four* maunds only. This, however, we need not take into account here. At the best of times the Tounghoo trade was comparatively small; and, moreover, the extremely unsettled state of the Ningyan and Yemethen districts, where the cutch coming to Tounghoo is chiefly produced, would be sufficient to account for the total collapse of this trade.

"The continuous decline in the Irrawaddy trade, however, is much more difficult to account for. The comment made on it in the Inland Trade Report is to the effect that apart from the disturbed state of the country the outturn in the upper province is declining. Prices were good throughout the year of report, a great inducement to manufacturers,

which was not responded to. Burmese apathy and laziness may account for a good deal; but it is scarcely likely that the people of the cutch districts near Myingyan would have failed to respond to the stimulus of good prices, unless at the same time the article had become more difficult to procure in some way. The dacoits produced this effect in Ningyan and Yemethen, and the result was that the supply fell practically to zero. But in the Myingyan district the same deterring cause was not at work, at least not more so than it had been in the later years of Theebaw's reign, and yet the supply goes down to little more than one-third of what it had been some four years before.

"The real cause will probably be found to lie in the reckless and wasteful way in which the supply has been dealt with. It is notorious that under the Burmese kings there was no conservancy of forests of any kind whatever. They were merely leased to the highest bidders—in many cases probably to the highest bribers—and then the lessees were allowed to do what they liked with them. They might destroy young timber, and they had no inducement whatever to consider anything but how to make the most out of the forests during the current leases. Not only was a premium put on reckless disregard of the future on the part of lessees; but no precautions were taken against destructive fires. We know how much attention the Government of India has found itself compelled to give to prevent the destruction of forests from both these causes; and seeing that in spite of all its precautions waste does sometimes still occur, it is easy to understand that under Burmese control, or want of control rather, the destruction was very heavy every year.

"Cutch, of course, is a less valuable product than teak, but here it is under the control of the Forest Department, and precautions are taken to prevent reckless waste and to safeguard and provide for future supplies. Nothing of this kind has ever been attempted in Upper Burma; and though, of course, the country must be thoroughly pacified before the same measures as are adopted in Lower Burma for conserving forest produce of all kinds can be completely applied to the new province; yet it is evident from the steady decline in the exports of cutch by the Irrawaddy route that the sooner this article is taken in hand the better. In four years the quantity of cutch exported by that route has fallen to considerably less than half, and though there is some little compensation to the people in the increased value consequent on the smaller supplies, still the total value in 1886-87 was under five lakhs, against a value of nearly eleven lakhs in 1883-84. In other words, thanks to the want of proper conservancy, the people of the cutch districts above Allanmyo have received during the past year about six lakhs of rupees less than they would have done had the Burmese Government been possessed of prudence and foresight. This is a serious loss to a poor people; and we trust that it may be found possible, at an early date, to take the necessary steps to revive this declining industry."

## COMPOUNDING FOREST OFFENCES.

Is "Ranchi" a Forest officer? He says so, yet I can scarcely believe it. His phrases are so exactly those with which I am familiar in the style of the 'garib-parwár' Revenue officer. What in the name of common sense is an "unfortunate offender." I can only say, with his views, an offender in "Ranchi's" Division must be a "fortunate" offender. I don't quite understand "Ranchi" when he says—"I never allow my subordinates to compound." If the power of compounding has been given to them, how can he interfere except to have it taken away again. But to return to my difficulty. With us, and I think rightly, only the Divisional officer has the power to compound. If the Divisional Forest officer enquires personally into each case, in what way is the offender better off in the matter of "backward and forward" journeys, than if he had been taken before a Magistrate? None, I take it quite the contrary. In fact, practically, in this way, the section is unworkable. The Divisional Forest officer must then compound on the reports of subordinates; in other words, though, theoretically, the power has been granted to him alone, and the responsibility is with him, still, in fact, he delegates the power and retains the responsibility. Surely common sense would say that the responsibility should go with the power, and then we have the necessary conclusion that the *power* should be granted to subordinates. Yet, here at any rate, opinion is almost unanimous that they are not fit to wield it. "A. J. C." quotes the present French practice, but surely, if he knows anything of French forest law, he cannot maintain that there is any comparison. Is "A. J. C." prepared honestly to say that his guards are fit to receive such powers as are given by the French *procés verbal* system, by which virtually a guard writes a man down as guilty, and leaves him to disprove it. "Ranchi" says, it is not necessary for "Ghati" or any one else to compound. Evidently "Ranchi" does not hail from this part of the world, or he would know that the higher powers (among whom by the way forestry is not directly represented) take "Ranchi's" view, that the unfortunate offender should be saved as much inconvenience as possible, and, time after time, regret that Divisional officers do not use the powers granted to them under section 67 sufficiently, and trust they will do so more freely in future.

"Ranchi" says that it is not a Forest officer's "special line" to work up a case for a Magistrate. I can only say I don't agree with him. I maintain that we have received in trust a most valuable property, and that it is a Forest officer's duty to take the

best possible means to protect that property. Further, I hold that the only way to protect efficiently is to make punishment as deterrent as possible, and this can never be under section 67, punishment under which is admittedly less rigorous than under section 25, &c. Arguments such as "Ranchi" puts forward in favour of the "unfortunate offender," it will be seen on reflection, are necessarily based on the assumption that the restrictions instituted since the latter's "younger" days, are not really necessary, have not been instituted for the good of the people through the forests, but for some other reason ; "to justify the existence of the Forest Department," I was once told by an honest and consistent though extreme exponent of those views. The fact is that certain restrictions having been instituted, we, as Foresters, at any rate, must hold, not only that they are necessary, but, that they are to be enforced, and even in the interests of those on whom these restrictions press, the truest kindness is not to enforce them in a half hearted way, which will ensure their being set at nought, constantly, for a long time to come. But to take care that in every case the punishment is as heavy and consequently as deterrent as possible. I could write much more, but I have taken up already too much room though I have condensed as much as I could.

GHATI.

*Note.*—In the N.-W. Provinces and Oudh, Divisional Forest Officers do not compound offences without a personal examination of the offender, and they keep a book for the record of offences compounded, in which they write a short account of the charge, of the statement made by the defendant, and of the award.

It is possible that Bombay Divisions are too large for this procedure to be followed, but we can assure "Ghati" that the plan works admirably here, and that no Forest Officer would think of sending petty cases to a Magistrate, and especially if they were first offences, nor would they send any case to a Magistrate until they had first enquired into the case most carefully themselves, in the presence of the accused, and frequently until they had referred the case to the Government Prosecutor for his opinion, as to the character of the evidence producible in court.

Cases sent up to a Magistrate thus give the Divisional Officer and the accused far more trouble than cases compounded, and offenders are generally most anxious for section 67 to be applied, instead of their being put to the expense and delay and uncertainty of a criminal trial before a Magistrate, which are very serious affairs in these Provinces.

None but Conservators and Divisional Forest Officers are empowered to compound forest offences under section 67 of the Forest Act in the N.-W. Provinces and Oudh. —[ED.]

---

## REPRODUCTION OF BAMBOOS.

YOUR correspondent "J. C. S. D. Mendes" has drawn attention to the above important subject, and it is one which all Conservators should take up and issue clear and definite instructions on ;

for, as we all know, bamboos are one of the chief and most useful produce of many of our forests, and there is no produce which is more likely to deteriorate and eventually entirely die off from want of a proper system of treatment and cutting. Indeed, some of us may remember forests which in former years were so thickly stocked with bamboos, that it was not thought necessary to place any restrictions on cutting until it was too late, and the evil of excessive cutting of young bamboos had taken place, and the result now is that such forests are mostly denuded, and only scattered clumps here and there are met with.

Of course basket makers, &c., must be allowed to cut young green bamboos to a certain extent, but their requirements could be easily arranged for.

The removing of dry "stools or bamboos" could not be carried out in practice in extensive forests ; also the suggestions 1 and 2 are hardly feasible ; but, excepting for basket makers, the limit of age and season of cutting might be fixed and arranged for with profit.

*20th December, 1887.* A. J. C.

*Note.*—In the Central Circle, N.-W. Provinces, it is prescribed that four bamboo shoots should be left on every clump, and Mr. Fernandez has advised leaving eight shoots in every clump in the bamboo forests of Dehra Dún, for which he has just written a Working Plan. He has estimated that four new shoots are produced annually by each mature clump, and considers that to enable the clumps to thrive no culms less than three years old should be cut. In the Sahâranpur Siwaliks the bamboo area is subdivided into nine blocks, only three of which are worked annually, and each block is then closed for two years. This system has been maintained continuously since 1881, and under it the yield of bamboos has been steady, and the bamboos have not become undersized. It is easier to control, in these rough hill-sides, than the other systems proposed, and under it, yearling culms, readily distinguished by having young foliage or none at all and by their colour, can be reserved if there is sufficiently good supervision to ensure this rule being observed.—[Ed.].

---

I THINK your correspondent cannot save bamboos by cutting out shoots and transplanting them, and that they will die when the parent clump dies. Some kinds die out after flowering every five years, others ten or more. In 1868, I planted a large bari of játi bamboo in Oboepore, and ere doing so made enquiry of the old men of that and other villages to see if I was safe.

They told me they had never seen their játi bamboos seed, such an event could not have been missed or forgotten. It is now 1887 and these have not seeded, nor have the játies of the villages around. I offered Rs. 5 for five seers of guaranteed játi bamboo seed, and so far got nil, so this kind has a long life, 60 or 70 years at least.

S. E. Peal.

## III. Notes, Queries and Extracts.

M. Potanin's Journeys in East Tibet and East Gobi.—A condensed report of the results obtained by the three years' journey of MM. Potanin, Skassy, and Berezovsky, in China, Amdo plateau of Tibet at the sources of the Hoangho, and East Gobi, has just appeared in the Russian *Izvestia* of the Geographical Society (iii. 1887). Without repeating what has already been mentioned in his letters, M. Potanin gives in his paper a masterly sketch of the physical characteristics of the various regions explored by his expedition.

The route followed was from Peking, across the Utai-shan mountains which border the Peking depression in the west, and where the well-known Utai Buddhist monasteries are situated, to the city of Kuku-khoto. Thence south, across the Ordos region, to Lan-tcheu, capital of the Han-su province, and to San-tchuan on the middle Hoang-ho, where M. Potanin spent the winter of 1884-85, while M. Skassy wintered at the above city, and M. Berezovsky at Hoi-siang, on the Sy-tchuan frontier of the Han-su province. Thence the expedition proceeded south-east to Min-tcheu on the Tao-he, and to Sun-pan. Lun-an-fu was the utmost point reached towards the south, and the expedition returned to Lan-tcheu to spend the second winter at the Humbum monastery, close by Si-nin. The third summer was spent for the return journey, which was made *viâ* Kuku-nor, across the mountains which separate the Tsaidam from the Mongolian plateau, and the cities of Han-tcheu and Su-tcheu. Then, taking a course due north, the expedition crossed the Gobi, as also several ridges continuing the Ek-tag Altai in the east, and the Hanghai ridge, and reached the Orkhon River, whence it proceeded to Kiakhta and across Siberia to Russia.

The Peking plain, covered with fertile loess, is separated by a series of three ridges built up of gneisses and limestones, from the plateau of the Ordos, watered by the middle Hoang-ho. Of Europeans, only M. Przewalski, the missionary Huc, and M. Potanin's expedition have visited the Ordos—a plateau about 3,300 feet high, covered with shifting sands, the best part of which is on their eastern border. Owing to the moistness brought by the numerous streams which flow towards the Hoang-ho, the sands on the eastern border are not so bad as those described further west by M. Prze-

walski, and the *barkhans* are covered with bushes of *Shyavyk*, *Artemisiæ*, *Hedysarum lævi*, and thickets of the *Pugionium cornutum*—a new shrub discovered by Przewalski; sometimes dark growths of Thuja cover the *barkhans*. The hollows between the sandy hills are either covered with some bushes or occupied by the fields of the Mongols, who chiefly grow *setaria*, buckwheat, and hemp. The wet depressions, covered by meadow-grasses and partly with Halophytes, and called *tchaidams*, are enlivened by the herds and the mud huts of the half-nomadic Mongols. The sands are steadily moved by the winds from the south-west towards the north-east, and this constant motion explains why the Chinese gave to the sand-desert the name of Sha-he, or "River of Sand."

In the highlands which connect the Tibet mountains with those of Shan-si the expedition spent fifty days. Thick layers of loess cover there the horizontal layers of salt-bearing sandstones and conglomerates. The region is a high plateau deeply burrowed by the *cañons* of the rivers, which sometimes are 2,000 feet deep, and are cut both through the loess and the sandstones. The narrow *cañons* are mostly waterless, while the broader ravines are watered by rivers and therefore are the seat of many villages. There is little wind or rain, and the atmosphere is charged with dust.

In Tibet the expedition crossed only the Amdo plateau, separated from the Mongolian plateau by the Nan-shan ridge. For 400 miles the expedition crossed there a region, the lowest parts of which rise above 7,000 and 8,000 feet. Even the Hoang-ho at Gui-dui has an altitude of 7,600 feet, and the valley of the E-tsin at the Pabor-ta-sy monastery is 8,000 feet high; the valleys of the Urunvu and the Tumun-guan are at altitudes of from more than 9,000 to 10,000 feet. The highest parts of the plateau rise, however, to 12,000 feet, and Lake Kuku-nor is spreading its waters at the height of Alpine peaks, *i.e.*, 10,700 feet. Still higher grassy plateaus, where it never rains but often snows, and marshes spread over large areas, rise to the south of the lake. Only a few of the mountain-ridges which inclose this plateau are snow-clad. It has a quite original flora, discovered by General Przewalski. Forests are few; as to the high meadows, they are inhabited by nomad Tangutes, and, on lower levels, by a mixed population of Chinese and settled Mongols described under the name of Daldas.

The Alpine highlands watered by the northern tributaries of the Blue River, which separate the Amdo high plateau from the Chinese lowlands, are the most picturesque part of China. The routes which cannot follow the bottoms of the narrow and rocky valleys pass over the mountains, flights of steps being cut in the

rocks, or wooden balconies being built along the steep slopes of the rocky hills. Suspended bridges, swinging under the weight of a mule, cross streams which flow in a succession of rapids and waterfalls. The Chinese monsoons deposit all their moistness on the south-eastern slopes of the mountains; thick forests of conifers on higher levels and of deciduous trees lower down, clothe the mountain slopes. Maples, lime-trees, oaks, *Helwingiæ* and a number of shrubs and climbing plants are growing in impracticable thickets, while all crags are thickly covered with ferns, mosses, and orchids. Mollusks (*Bulymus* and *Helix*) cover the crags by thousands. And finally at the foot of the mountains the sub-tropical flora—palms, bamboos, banana-trees, and tea-trees—makes its appearance.

The villages and the towns—clean and well-watered—are strikingly picturesque, as the houses (with windows, like our European dwellings) are built in the shape of amphitheatres on the slopes of the steep forest-clothed hills. In some towns the roofs of the houses are the workshops and sitting-places of the inhabitants. The valley of the "Golden Lakes"—Kser-ntso—with its background of snowy peaks is especially picturesque.

As to the region crossed between the Amdo plateau and Kiakhta, it is sharply divided into two parts. The southern is a true desert, which stretches towards the north as far as the Khangai Mountains. The Nan-shan rises as an immense snow-clad wall on its southern border; then comes a narrow strip of inhabited and cultivated land, which is followed by a gravelly desert, where only a few trees of *Haloxylon Ammodendron*, and bushes of *Calligonum* and *Ephedra* grow here and there, while the course of the E-tsin is marked by narrow strips of meadows covered with *Elymus*. The depression of the E-tsin, which flows into the Gashiun-nor, has an altitude of only about 3,000 feet, and it is bordered in the north by the Tostu ridge, and three other parallel ridges, of which the northern is snow-clad. The valleys which separate these four ridges are waterless; old river-beds, now dry, are seen on their bottoms, but even the *Haloxylon* forests which formerly grew in their valleys are now disappearing, only decayed trees having been seen by the expedition.

As to the plateau in the north of the Khangai Mountains, it is covered with rich meadows, while the slopes of the hills are clothed with forests of larch; the Siberian cedar-tree also makes its appearance. In the lower valleys the Mongols carry on some agriculture.

The above account is followed by an ethnographical sketch of the Ordos-Mongols and the Daldas.

The results obtained by the expedition are very important. A survey has been made of a stretch of no less than 4,400 miles. Latitudes and longitudes have been determined at sixty-nine places. Two hundred photographs, 700 specimens of mammals and birds, a bulky herbarium, and rich collections of lizards, insects, mollusks, and rocks have been brought in. M. Berezovsky still remains in the region he has become so fond of, and he wrote last February, from Hoi-siang, that his journeys about Si-ning and Tai-tchan have enriched his collection with 500 more specimens of birds, some of which are very interesting.—P. A. K.—*Nature.*

---

THE TRUE CAUSE OF THE BREAKS IN THE NORTH-WESTERN RAILWAY.*—The annual floods, which have recently occurred, and since 1884 in the neighbourhood of Umballa and Jagádhri, have generally been ascribed to the denudation of the outer ranges of hills of forest trees and under-growth. This would be sufficient to account for sudden floods over a limited area, but is quite insufficient cause to explain the marked increase in the rainfall which has taken place. In 1884 a very heavy downpour occurred north of Umballa, causing destructive damage in Umballa Cantonment; on two or three separate occasions long breaches have been made in the North-Western Railway on both sides of Umballa; and in the present year heavier rain has been experienced in the neighbourhood of Kasauli than has been known for years.

The true cause is to be found in the large increase in irrigation which has taken place, south-west of the site of these floods (in the districts of Sirsa and Ferozepore, 130 to 150 miles,) since the opening of the Sirhind Canal.

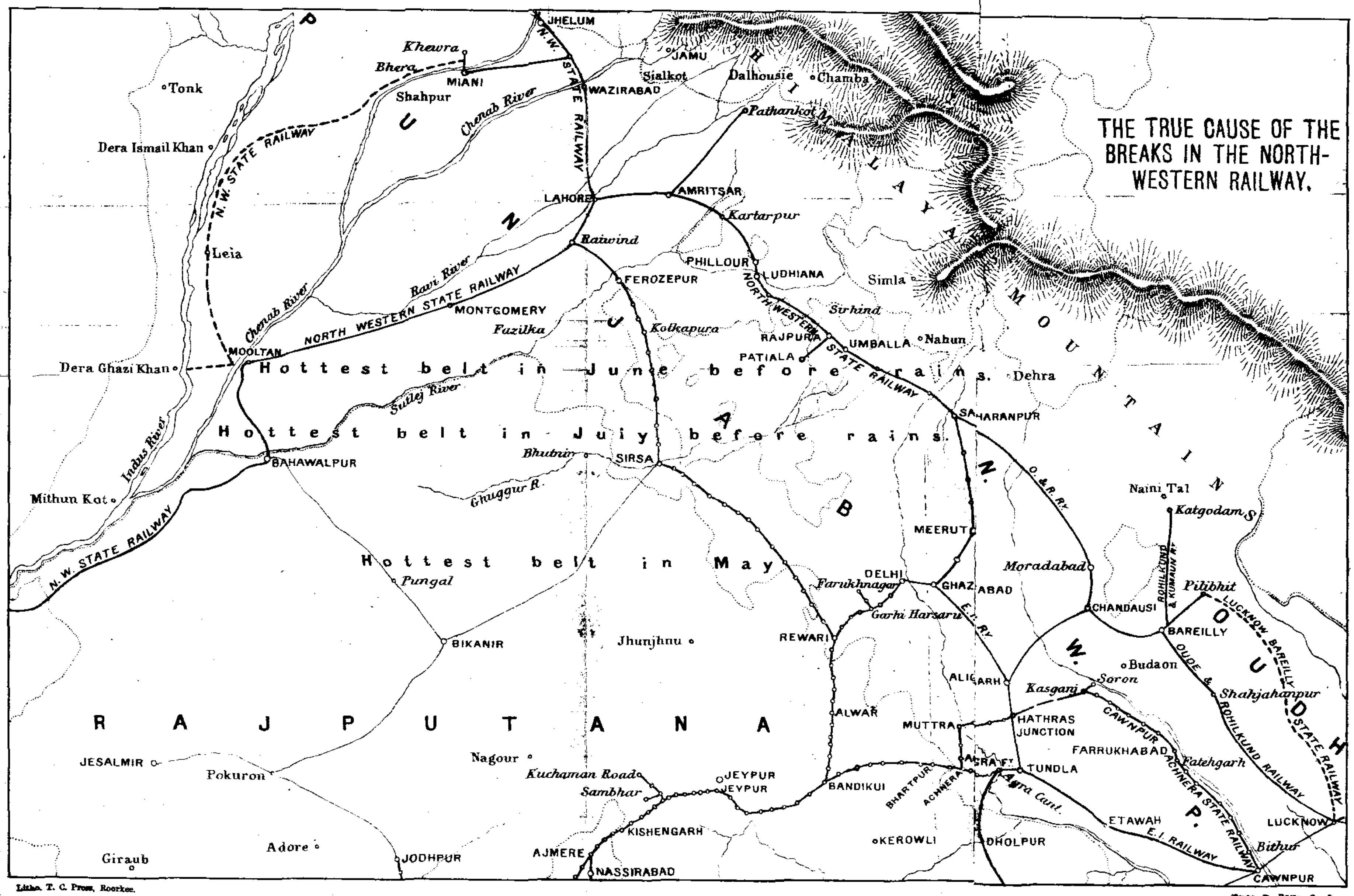
To explain fully the action which probably brings about this increased rainfall in the month of August particularly, it will be necessary to make use of figures: first, to get an idea of the amount of water evaporated in one day; and, secondly, to obtain an approximate of the quantity of water which could be absorbed by dry air, such as would generally be found over a sandy desert, before condensation took place.

Take any area 50 miles by 20 miles in the neighbourhood of Sirsa, and suppose that of this 1,000 square miles $\frac{1}{400}$th part is daily under irrigation; then allowing $\frac{1}{5}$th of an inch for daily evaporation, we obtain the large quantity of one million cubic feet of water drawn up into the atmosphere daily.

A cubic yard of dry air at 80° Fah. will absorb the same number

---

* By J. E. Hilton, M. Inst. C.E., Executive Engineer, P. W. Department, Punjab.


THE TRUE CAUSE OF THE BREAKS IN THE NORTH-WESTERN RAILWAY.
PUNJAB
N.W. PROVINCES
OUDH
RAJPUTANA
HIMALAYA MOUNTAINS
Hottest belt in June before rains.
Hottest belt in July before rains.
Hottest belt in May
N. W. STATE RAILWAY
NORTH WESTERN STATE RAILWAY
O. & R. RY.
E. I. RY.
E. I. RAILWAY
ROHILKUND & KUMAUN RY.
LUCKNOW BAREILLY STATE RAILWAY
OUDE & ROHILKUND RAILWAY
CAWNPUR ACHNERA STATE RAILWAY
Indus River
Chenab River
Ravi River
Sutlej River
Ghuggur R.
Jhelum
Khewra
Bhera
Miani
Shahpur
Wazirabad
Jamu
Sialkot
Dalhousie
Chamba
Pathankot
Tonk
Dera Ismail Khan
Leia
Lahore
Amritsar
Kartarpur
Raiwind
Phillour
Ludhiana
Simla
Ferozepur
Sirhind
Montgomery
Fazilka
Kolkapura
Rajpura
Patiala
Umballa
Nahun
Mooltan
Dera Ghazi Khan
Dehra
Saharanpur
Bahawalpur
Bhutnir
Sirsa
Mithun Kot
Naini Tal
Katgodam
Meerut
Moradabad
Pungal
Delhi
Farukhnagar
Ghaziabad
Chandausi
Pilibhit
Garhi Harsaru
Bareilly
Bikanir
Jhunjhnu
Rewari
Budaon
Aligarh
Kasganj
Soron
Shahjahanpur
Alwar
Muttra
Hathras Junction
Farrukhabad
Fatehgarh
Jesalmir
Pokuron
Nagour
Kuchaman Road
Sambhar
Jeypur
Bandikui
Bhartpur
Achnera
Agra Ft.
Tundla
Agra Cant.
Kishengarh
Etawah
Lucknow
Bithur
Adore
Kerowli
Dholpur
Giraub
Jodhpur
Ajmere
Nassirabad
Cawnpur
Litho. T. C. Press, Roorkee.
Thos. D. Bona, Supdt.

of grains of water. Allowing that the air already contains 50 per cent. of full saturation, a cubic yard will further absorb 40 grains Troy; after allowing for decrease of absorption due to decrease in the temperature in the upper strata of air, a cubic mile will absorb not less than 350,000 cubic feet of water, and the atmosphere to one mile in height over 1,000 square miles is therefore capable of containing 350 millions of cubic feet of water. A sudden decreased temperature of 10 degrees would precipitate 70 millions of cubic feet. In April, May and June the hottest belt of country in India is to the south of the district of Sirsa, extending across the Rájputána desert from Delhi to Bahawalpur.

The hot air over this part rises and is replaced by a current of air on the south from the Indian Ocean, bringing with it the south-west monsoon; and on the north by a current of air from the north and north-east, carrying with it the more highly vapourized atmosphere which has generated over the Sirsa district. This vapour at this time of the year is dispersed, and only raises slightly the degree of moisture in the air over the desert.

Towards the end of June, and beginning of July, a change takes place, the belt of greatest heat passes over Sirsa and extends from Sahåranpur to Jhang and Montgomery, constant changes of the wind occur, caused by greater heat on the one side or the other. The million cubic feet of water which is daily evaporated over the irrigated district is wafted hither and thither east or west, and for some days may accumulate; finally, the belt of greatest heat advances to the north of Sirsa, and the wind follows it.

Instead, however, of being drawn directly north, it deviates to the east, under the laws affecting currents of air passing from the south to the north, owing to the rotatory motion of the earth.

The wind becomes a south-west wind, carrying with it the accumulated moisture of several days; passing over Patiála and Umballa, it meets with a colder air coming from the hills, and by the sudden decrease of temperature the vapour of water is precipitated in floods of rain.

The same action probably takes place during a break in the rains. After a heavy fall of rain under the low hills, the belt of greatest heat is drawn back to the south of Sirsa, then gradually advances again to the north, and a repetition of the flood occurs.

It may be argued from this, that the larger the break in the rains in the neighbourhood of Umballa and Lahore, and the greater the heat, the greater and more severe the flood of rain will be when it at last bursts.—*Indian Engineering.*

*The 10th November, 1887.*

THE FORESTRY COMMITTEE.—This Committee, appointed to consider the best mode of promoting forestry and arboriculture, met on Wednesday last, under the presidency of Sir Edmund Lechmere.

The Rev. John M'Lellan, Principal of the Royal College of Agriculture, Cirencester, was examined with regard to the kind of practical instruction given there. They had 87 students at the college, and they were instructed in levelling, mechanics, chemistry, botany, and general farming. They had ample opportunities for teaching forestry in the Forest of Dean. A school for forestry might be started in connection with the Royal Agricultural College, but if a National School of Forestry were established, it would require £100,000. He believed that a much higher instruction in forestry would be a commercial gain to the country. *In Scotland, where forests had been planted*, the value of the land had increased as much again as arable land.

Lord Ducie, Chairman of the Royal Agricultural College, was next examined, and said he was of opinion that all estate agents should study forestry. The students at the Royal Agricultural College varied; they had men who had been colonels in the Army, commanders in the Navy, Indians, and foreigners. Men could live as economically as they liked when at the college.

Mr. Elliott, of Ledbury, Gloucestershire, thought the Forest of Dean would be an admirable place where experiments of forestry might be made. The development of forestry would undoubtedly be a national gain.

Lord Bathurst said his park adjoined the Royal Agricultural College at Cirencester, and he had woods extending over 2,500 acres. He should be glad to give facilities for lectures and illustrations on forestry to be given in his park. He thought there was only one alternative on this question; they must either go in for a very large scheme or try and supplement the present system of instruction by enlarging the Royal Agricultural College. He did not, however, think that forestry should receive more support from the State.

Sir James Campbell, Manager of the Forest of Dean, said the forest contained 16,000 acres covered with wood. They trained their own men in the west of England for forestry purposes. He thought there should be a representative body for forestry, but he did not think the scope for forestry in this country was sufficiently large to require a national school, the education given at the Royal Agricultural College in his opinion being quite sufficient. The witness gave the result of the advantage of transplanting

trees, which several of the Committee said was evidence of a most valuable kind.

Mr. Brittain, timber merchant, Wolverhampton, gave some information as to the importation of foreign timber, and

The Committee then adjourned.—*Timber Trades Journal.*

---

LIGHT AND THE FORMATION OF FLOWERS.—Prof. Sachs gives details of the experiments from which he has come to the conclusion that the ultra-violet and invisible rays of the solar spectrum are especially efficacious in the development of flowers. The experiments were all made upon the nasturtium (*Tropæolum majus*). If the rays of the sun are made to pass through a solution of sulphate of quinine, the ultra-violet rays are entirely absorbed or transformed into rays of less refrangibility, which are visible and of a light blue colour. If a plant is made to grow behind a screen of sulphate of quinine, the vegetative organs continue to be normally developed, but the flowers are entirely suppressed. Twenty-six plants thus grown produced between them only a single feeble flower, while twenty-six other plants grown under similar conditions, but behind a screen of pure water of the same thickness, produced fifty-six flowers.

The learned Professor believes that extremely small quantities of one or more substances formed in the leaves cause the formation of materials which are conveyed to the growing points to take the form of flowers. Acting like ferments, an extremely small quantity of these flower-forming principles may act upon large quantities of plastic substances. It may be assumed, then, that there are three distinct regions of the solar spectrum, differing from each other in their physiological action: the yellow rays and those near them cause the decomposition of carbon dioxide, and are active in assimilation; the visible violet and the blue rays are the agents in movements of irritation; and the ultra-violet rays are those which produce in the green leaves the substances by means of which the flowers are developed.—*Scientific American.*

---

FORESTS AS PROTECTION AGAINST FLOODS.—The "Englishman" asks:—"Are forests on the slopes of hills in India any protection against the flooding of rivers?" and then goes on to say:—"It has hitherto been commonly believed that they were, and the absence of timber in many places has been greatly deplored. But Mr. H. G. Turner, the Agent to the Governor-General in Viza-

gapatam, has come forward to deny the truth of this accepted theory, so far at least as many parts of the Madras Presidency are concerned. In the many jungles on the hills which Mr. Turner has visited, he has never seen a single spring of useful dimensions issuing in the hot weather from the hill-sides in Southern India. Rivers in that Presidency almost invariably have their origin on plateaux and in sloping valleys, and are formed by the gradual off-flow of the rainfall of the country. All we can say is that, while this may be true of Madras, it is equally true of the hills in some parts of Northern India that the water rushes down the hill-sides very much as if they were corrugated-iron roofs. Torrents and floods are thus formed, and to the hills we must look for the secret of the disasters by which communications are annually cut off, and the Government of India at Simla is left suspended in the predicament of Mahomed's coffin. Madras, it seems, is more fortunate."

---

ANALYSIS OF FOREST PRODUCTS.—The following extract from the report of R. Romanis, Esq., D. Sc., Chemical Examiner, Burma, is of interest to foresters :—

"The most interesting of these was the wood of *Artocarpus integrifolia*, which yields a fast yellow dye much used by the natives. It may be extracted by boiling the wood with water, but more conveniently with alcohol. As thus prepared it is a resin resembling the colouring-matter of turmeric—

*Composition—*

| | |
|---|---|
| Carbon, ... ... ... ... ... | 61·67 |
| Hydrogen, ... ... ... ... ... | 6·67 |
| Oxygen, ... ... ... ... ... | 31·66 |
| Total, ... | 100·00 |

"The leaf of the teak tree when crushed yields a red dye which dissolves in alkalies, forming a blue or violet solution. It is a mixture of two or more substances. The colour is principally due to a crimson body which may be separated from the others by ether, which dissolves it. It forms insoluble compounds with lead and baryta.

"The *nim* tree, used as a febrifuge in India, yields a resin which appears to be the active principle. The examination of it is not finished.

"*Organic Analyses.*—These were various products from teak examined at the instance of the Forest Department. There is a dye resembling litmus extracted from the leaves, while two or three may be prepared from the resin which contains a quinone hitherto unknown from which they are derived. This substance also is found in teak-tar. The quantity varies with the age of the tree, being greatest in old trees."

THE

# INDIAN FORESTER.

Vol. XIV.] March, 1888. [No. 3.

## THE ROAD TO PANGI (CHAMBA).

FROM Chamba to Kilar in Pangi there are seven marches as follows :—

| | Elevation. | | | |
|---|---|---|---|---|
| Masrund, | 4,000 feet, | 12½ miles, | road very steep and bad in parts. | |
| Kalel, | 4,000 „ | 9½ „ | mostly easy, but parts steep. | |
| Tisa, | 6,000 „ | 12 „ | „ „ | |
| Alwas, | 7,000 „ | 12 „ | „ „ | |
| Salrundi, | 11,000 „ | 11 „ | steep in parts | cross Sach Pass |
| Donai, | 10,000 „ | 7 „ | „ „ | 14,328 feet. |
| Kilar, | 8,400 „ | 10 „ | steep but good road. | |

An alternative for the two first is Tundu (5,000 feet), 12 miles; Chunan (forest house 6,500 feet), 12 miles; Kalel, 6 miles.

The regular road from Chamba to Pangi is, as stated above, *viâ* Masrund to Kalel, but this has many drawbacks; in the first place the road is badly laid out, violating all scientific principles, parts of it being so steep that to call it a "bridle road" is a mere mockery. The easiest way to ascend these parts is to get off one's pony and drive him ahead or lead him. Again, after going up a miserable road, too steep to ride, one finds one has immediately to descend just as bad a piece. This sort of thing is, to a well regulated mind, simply maddening, and on arriving at camp one finds, as stated by Andrew Wilson in his "Abode of Snow," that "feelings of exasperation are in the ascendant." The Chamba State is not remarkable for good roads anywhere (except in the Barmaur valley), but there are places on this "Main road to Pangi" that could not be surpassed for vileness in any country, and yet there have been European officers as Superintendents for many years. Those who have not constructed roads are apt to imagine that they cost too much to be thought of, yet

o

an excellent road could be made through this line of country for about Rs. 200 to Rs. 300 per mile. Another drawback in the [illegible] route is, that it is on the south side of the range, and is thus exposed to the full rays of the sun. A much pleasanter road is that up the Sao valley *viâ* Tundu as far as Kalel, at which place the main road is again joined, onwards it is not so bad. The first march up the Sao valley is about 12 miles to a place called Tundu, rideable for about 7 miles, at a walk, then merely a footpath ; this route has one great advantage, that of being on the northern side of a range, so that starting at about 4 p.m. in summer, one can travel in shade nearly the whole of the first march, and next day by starting early, be up at a high elevation before the sun appears.

The Raja is making a grand road up this valley to his Sao "Kothi," which will join the old Hul-Chánju road, and this will, when completed, probably become the "main road" as far as Kalel. Beyond Tundu the Forest Department are making a good bridle path, which will in time nearly join on to the new Sao road, leaving a connecting link to be improved. From Tundu onwards the road gradually ascends at an easy gradient to the top of the Rundhar range, and then as easily descends through the Chatri-Sikri forests to Kalel, a distance of 16 to 18 miles. At present this new road has only reached to about a mile above Tundu, but will be extended next year. It is a good road about 6 feet wide, and, including walling where necessary, stone causeways at nallas and a little blasting, has as yet cost only Rs. 150 per mile for 8 miles. It passes over the range at about 9,000 feet elevation, and continues on through the Chatri-Sikri forests to the village of Chunan ; it is the main road here, of a system that will in time traverse the whole forest, being joined at various points by footpaths 2 feet to 3 feet wide, costing Rs. 30 to Rs. 60 per mile. The descent from the Pass is through glorious forest scenery to the village, on the boundary of the forest. Just above the village on an open spur, but sheltered by a grove of grand oak trees, stands the forest house. This was built in 1886, and is a neat little house constructed entirely of deodar timber, containing one central room and two smaller ones, verandahs, &c.

It is a comfortable clean little place, and cost Rs. 540 exclusive of the value of the timber. This style of house is preferable to the old one of kucha walled houses that used to be built, and experience has shown that these wooden houses last fifteen years or more with very little repairing being required.

The house was a necessity, because there will be much work in this valley. The three forests of Chatri, Sikri and Rupani, which

adjoin here, contain in all over 2,500 acres, a very large block for the Chamba State. Besides the destructive part of forestry, *viz.*, felling, a great deal of regeneration work of all kinds is being done here. There are seven nurseries well stocked with deodar plants for future planting. A great deal has also been done in the way of cutting out and girdling inferior species in the vicinity of deodars; portions have been closed to grazing with excellent results, and many places have been terraced under seed-bearing deodars, these have been most successful; in many instances the terraces have the appearance of well stocked nursery beds. Where the inferior species have been cut, are to be seen hundreds of deodar seedlings, and though many die the first year, still sufficient survive to re-stock the area. Among the inferior species the "killar" (*Parrotia Jacquemontiana*) gives the greatest trouble, as each tree, as it were, is composed of perhaps twenty or more stems, all of which have to be cut, besides which, it coppices very freely. Planting of deodars has also commenced in Chatri forest, and will go on regularly now.

These forests have been recently worked for sleepers, but still contain some 3,000 first class deodars, which will be felled ten years hence. The distance from the sleeper works to the river Siul (a tributary of the Ravi) varies from 5 to 8 miles. The sleepers are partly dragged and partly carried by Kashmiris, who come from the Púnch country, and are a fine athletic race; they come over yearly to the work, to the number of 200 or more. In the steep parts of the forest they drag the sleepers over a path made for the purpose; slabs are laid on the path, and the sleepers dragged on these by means of an iron peg driven into the end of the sleeper, a second sleeper is joined on, and in this way two are taken down at the same time. When the more level part of the road is reached the friction becomes too great, and the sleepers are carried on the men's shoulders, this will show what a strong set these Púnchis are, for these "green" sleepers containing about 4 cubic feet each, must weigh about 160 pounds. The whole lead is divided into daks of some 2 miles each, and one man takes perhaps six sleepers a day. Just above the river there is a very steep bank, some hundreds of feet high, this was a great obstacle. It was overcome by means of a sleeper shoot 2,300 feet in length, which zigzags down the face of the cliff. This shoot is formed of rejected sleepers placed on edge on either side, the bed being made of slabs nailed on cross pieces, and is sufficiently steep to take the sleepers down of their own accord; it works excellently. At each turn in the zigzag, and there are seven in the whole distance, there is a

soft bed of earth and branches into which the sleeper falls; a man is also stationed at each turn, who quickly shunts the sleeper round into the next turn and off it goes. The last portion of the shoot for about 50 feet is nearly level so as to lessen the speed, but is kept watered to preserve an even run, and the river bed at the place where the sleepers finally drop into the water, has been deepened and freed from large stones to prevent damage. The sleepers take four minutes to go the whole distance, ending up with a graceful "header" into the river at the bottom of the shoot. Formerly they used to be simply thrown over the cliff, and of course 20 to 40 per cent. were broken in the process; now, perhaps, one in a hundred is damaged by being jerked out of the shoot. The highest rate paid is Re. 1-1 per sleeper for the greatest distance, and includes felling, logging, sawing, carriage (with cost of making paths in the forest) and launching; the cost of conveyance to the sale depôt at Lahore is 2½ annas, and as they sell for from Rs. 2-12 to Rs. 3-4 each, a handsome profit is made at present. The Púnchis who do all the carriage are the only people who will undertake it, the Chambese are too lazy, weak and well off to attempt it except here and there. Each Púnchi makes between Rs. 50 and Rs. 100 clear profit during the season to take back to his home. I asked if they were not becoming very rich, but was told that there was "barra zulm" in their own country; they have to pay Rs. 3 yearly for each buffalo grazed, and one anna for each sheep or goat, against 13 annas and one pie respectively in Chamba territory. They say they prefer to work for us, though it is eleven marches to come, because in Badrawar (Kashmir) they are paid partly in grain, of which they do not approve. The sawing of the sleepers is, however, done partly by Chamba villagers and partly by men imported from Amritsar. The latter do the best work, but are more expensive, and if the Chamba men would only work regularly, I should employ them only; but as I have said they are too well off. After working for a week it becomes necessary for them to go home for a marriage or a "mela," and thus they are not to be depended on. The number of local sawyers is, however, yearly increasing, as they find the work pays very well, and their sawing is improving, so that in time it is hoped we shall be independent of outsiders, who are apt to make a flitting with their advances to the grief of the contractor. In another way our works have an excellent result, and that is, the villagers can now saw up trees given for building instead of as heretofore, hacking them with axes; in this way there is great economy of timber to the benefit of the forests. Another point in favor of local men is that they do every part of the

work themselves; fell the tree, cut the logs, and erect them for sawing; the Amritsar men can only saw, all the rest has to be done for them by others. Still, at present their work is better, and they do more, as they are too far away to want leave to their homes at any time in the season.

There is shooting to be had on the Sao valley route, black bear, "gural" on the steep grassy slopes, serau ("jangál" in Chamba) in the dark sheltered forests; in the higher elevations there are many "monál" and argus ("nil" and "phulgar"), and of course "koklas" and "kalij" ("kokrola" and "kolsa") pheasants lower down. There are also woodcock to be found now and then, but very few; these are driven down to Chamba when there is a heavy fall of snow, and in 1882 no less than 68 of them were shot in and around the town in one or two days. The ferns are the ordinary mid level ones, the rarer being *Polypodium membranaceum*, *Notholæna vellea*, *Aspidium Thomsoni* and an *Asplenium (Athyrium)*, which I have only just found. I am told this is *A. macrocarpum* var. *Atkinsoni*, but am doubtful, as it is not at all like the specimen I have from Darjeeling, where it is very common. As yet I have only seen it in this one place, growing on a steep cliff almost out of reach, at a spring strongly impregnated with iron. It is curious how local some of the ferns are in Chamba, thus, I have only found *Asplenium pekinense* on one rock near Chamba, *Pteris Wallichiana* at one spot in Majaur forest, *Polypodium Stewartii* on one rock above Alwas, *P. (drynaria) rivale* on a single tree up the Sao valley, *Cheilanthes Szovitzii*, a single plant only, near Sach in Pangi, and yet I have been several years here, and have always kept a good look out as I walk along.

From the forest house at Chatri down to Kalel, there are two roads or paths, both made by the Forest Department; by one, which runs through the Sikri forest, it is about 7 miles; by the other below the Rupani forest a mile or so less. This latter is much steeper, and not as good as the other; both pass through a very pretty country. A curious accident happened on the Sikri road last year, where it descends a steep hill by zigzags. There was a great mass of snow lying on the hill-side, and while two villagers were going down over it, the whole mass slipped down and buried them at the bottom of the hill; one man managed to extricate himself, but the other was so deeply covered up that he could not be got out for several days, and was of course dead. It happened in March, when the snow was melting and liable to slip at any moment, so the men should have known better than to expose themselves to the danger. By the way, Mr. Editor, can you or any of

your readers give me an authority for the word "lavine," meaning a snow-slip like the above? Some one gave me the word with that signification, but I have never met "any other buddie," as Dr. Stewart used to say, who had ever heard the word, nor can I find it in any dictionary. At Kalel there are two encamping grounds, one the public one down by the stream in a very hot confined valley; the other half a mile higher up on an open spur called Gutkar, here a forest house has just been built, which will be very useful to Forest officers and travellers. The only drawback is the distance from which water has to be brought, but this is compensated by the cool situation compared with Kalel. In a former contribution was mentioned the Chamba sandal ("chapli"), and I was rather disposed to decry it as a form of foot-gear, but subsequent experience has led me to form a better opinion of it, and I now use nothing else in dry weather. They are more comfortable than boots, which are apt to produce blisters on a hot march with much up and down hill walking. The local "Watts" too has improved in the manufacture, the sole is now made of good stout buffalo leather, and if the "stockings" are sewn with leather instead of thread, they last a very respectable time, and at Rs. 2-4 each in these days of a debased coinage, are much cheaper than English boots. It is quite astonishing what a number of people have taken to them, they now go to such places as Cawnpore, Ajmere, and lastly Upper Burma. In this respect the country shoemaker can beat the English one, for I tried the experiment of getting a pair made by a London bootmaker, and not only did they not last half the time, but the cost was about eight times that of the Chamba chaplis. While on the subject of gear might be mentioned a form of nether garment, which I have found to surpass all others for hill walking; it is something like that worn by native infantry regiments, and consists of knickerbockers with gaiters attached. While wearing this one has all the freedom at the knees which knickerbockers give, without the heat produced by long stockings and the extra gain that nothing can get into the boots while walking. A buckle below the knee prevents slipping down, and if made of khaki drill, it is the best form of trouser for hill walking in the summer. The great thing is the freedom at the knees, and those who have done much steep walking will understand this. The hill people do, for they wear a garment which is exceedingly free, not to say baggy, at the knees.

But, to resume (a phrase considerably shorter than the hackneyed French equivalent) the next march is from Kalel to Tisa, 12 miles or so. The first part for some miles is an admirable road,

scientifically laid out by a European years ago, and contrasts most favorably with the ancient road made, I believe, to my sorrow be it said, by the Forest Department. The present road ascends at an easy slope from the Kalel nala, and then proceeds on a level, with steep cliffs above and below for several miles, and then descends gently to the Tikri nala. A friend (G. W. B.) had a strange experience on this part of the road in 1884. I must premise that he is a great shikari, and the height of his ambition for years past had been to shoot a leopard, and he had never succeeded. He was returning to Chamba from Tisa, and had with him two fox terriers, the remnants of a pack which had gradually disappeared by natural and accidental deaths ; as there was apparently no chance of game between the Tikri nala and Kalel, he had left his rifle some distance behind, and was jogging along with the dogs in front of him. Suddenly a huge leopard sprang out of some scrub above the road, caught up one of the dogs and ran down into the bushes below ; B. shouted and did all he could to make the leopard drop the dog but without avail ; the other dog barked and finally ran after the leopard into the jungle, and B. could hear its bark getting fainter and fainter, and could make out that it was evidently steadily following the leopard. He and a peon went down and shouted and threw stones without effect ; finally he heard a sharp yelp and then silence, and he never saw his dog again. Thus in a few moments he had missed bagging a leopard, never having had such a splendid chance, and had also lost the last of his dogs ! The second dog must have followed out of sheer affection for the one taken by the leopard, as the two were very fond of one another. B.'s feelings may be "better imagined than described." At about 2 miles from Kalel the road passes under a great precipice, where I had a narrow escape some years ago, one rainy day, a huge stone falling on the road, breaking it away so as to be almost impassable, within 50 feet of me ; luckily I was walking, having just dismounted, but my pony very nearly went over the khud from fright. After crossing the Tikri nala the road ascends towards Tisa, finally crossing the Bagota nala over the remarkable chasm before described (Chamba trip), 20 feet wide and 160 feet deep. On the whole this is a nice march, and can be done within five hours going at an easy pace. The only notable fern to be found on the road is *Gym. vestita*, rare in Chamba, which grows on some dry rocks above the road. At Tisa *Cheilanthes fragrans* is very common, growing out of the walls supporting the edges of cultivation. Tisa is a very uninteresting place, a large village for Chamba, with a "kothi" built on a

barren hill-side and very hot in summer, though at an elevation of about 6,000 feet. Sand flies are particularly bad in summer. There is a forest house here, a fairly comfortable one, much appreciated by travellers who have been long in tents. A hospital has lately been built by the Raja of Chamba, which will be of great service to the surrounding villages, as this is the most populous district in Chamba.

The next march from Tisa to Alwas is 12 miles, and a fairly easy stage. The road first ascends a steep ridge behind Tisa, by hot and dusty zigzags, but shortly after runs nearly level, and passes through the small (deodar) forest of Dauri, which affords grateful shade and some pheasant shooting. The upper part of the forest, which was once a grass blank, was closed to grazing, and partly planted with deodar, and natural reproduction having also succeeded, it is now a dense thicket of nearly pure deodar, almost impenetrable in places, and a favorite resort of black bears when the millet crops are ripe in the adjoining fields. Onwards the road runs almost level for about 4 miles, till it rapidly descends into the Baira nala. The left bank of this stream is shady and moist, covered with a dense growth of nettles in the lower parts, (*U. dioica* and *urens ?*) which supply nearly the whole district with fibre for rope-making, and are also used as a vegetable. Their medicinal properties do not appear to be generally known, nor does the yellow dye yielded by the roots when boiled with alum appear to be used in Chamba. Beyond the Baira nala the road mounts up a steep grassy ridge to avoid precipitous ground along the Alwas stream, which flows through a deep chasm some hundreds of feet below, and passing at a fairly level gradient through the village of Sarwas, gradually descends through a shady bit of broad-leaved forest of walnut, maple, &c., to the water's edge. A nice little wooden bridge spans the stream at Trail, and the level space on the bank of the stream makes a pretty and convenient place for breakfast if an early start has been made from Tisa. The four miles of road from Trail to Alwas are capable of much improvement; from the bridge the road rises by steep zigzags to the village of Kokru, and then goes slightly downhill to Salog, while it might easily have been taken nearly level onwards, and thus avoided several unnecessary ascents and descents towards Alwas. A grove of fine deodars surrounding the temple of the Nil deo above the road is a prominent feature of the scenery beyond Salog. This god is the local clerk of the weather, and is propitiated by being bathed in milk and besmeared with *ghi:* a slight fall of snow or even rain elicits a cry of "Ai Maharaj"

from the coolies who are passing. Alwas is a pretty camping ground on a gentle slope above the junction of two streams, the Sarunda and Wang, and surrounded by firs and oaks. An evening stroll into the forest with dog and gun is generally repaid, as koklas and monál are numerous. Black and brown bears are also to be got in the Sarunda nala, and the local shikari, Binoo, lives close to the encamping ground, and is always ready to show their haunts.

From Alwas the next march to Salrundi is a fairly easy one. Salrundi is merely a camping ground, known as "haliás" in these regions. If pressed for time the traveller would not halt here, still a halt is well repaid, for the scenery is grand, and there is a charm in being up in this region of mighty mountains covered with eternal snow. The road rises steeply from Alwas, passing at first through mixed forest, then through a belt of pines, and finally emerging into the treeless upper region, which during the summer is a beautiful sight, the grassy slopes being carpeted with flowers of every hue. Midway there is a large nala, called the Bhujopur nadi, and in this are to be found several good ferns—*Cryptogramme crispa*, *Pellea gracilis*, *Nephrodium Barbigerum*, *Brunonianum* and *odontoloma*, *Aspidium Prescottianum* var. *Bakeriana*, and on a rock at the side of the road *Polypodium Stewartii*, also some varieties of *Asplenium* (Ath.) *filix fœmina*, such as *attenuata*, *dentigera* and *retusa*. Above and below this nala are a number of open spaces, known as "góts," which are good places for the brown or snow bear, in April and September, and of course hereabouts, in the forests there are many monál and argus pheasants and snow partridges and pheasants. Salrundi lies at an elevation of about 11,000 feet, the Sach Pass being 14,328 feet. There is a hut under a mighty rock, but as it is used by shepherds, no civilized being can stay in it owing to the vermin which infest it. The Sach Pass is the easiest in Chamba, a pony can be ridden nearly the whole way to the top when the snow has melted in August. Perhaps the best time to cross is in June, when the snow is hard, and extends for some miles below the Pass on either side. From Salrundi to the Pass there is no road to speak of, as the snow obliterates it every year, but there is no difficulty in getting to the Pass except that on the last few hundred feet steps have to be cut in the hard snow. Towards Dalhousie there is a grand view of mountain and valley, but on the Pangi side there is nothing to be seen, as the valley is a very narrow and winding one. The Sach Pass can be crossed up to about the 15th November. The descent to Donai is steep, in May and June the road

lies over hard snow all the way, but in August the snow does not extend so far, and the path is a very hot and dusty one. The rare ferns on this road are *Adiantum pedatum*, *Asplenium fontanum*, *Polypodium dryopteris* and *Pellea gracilis*, the last having a very pretty delicate frond. Donai is a wretched place to camp at, being situated at the junction of two nalas, down which a very cold wind blows ; attempts have been made to build a forest house here, but the avalanches have been too much for it, and nothing now remains but a few pieces of stone walling. The final stage into Kilar is about 10 miles long, and is an interesting march, as the road passes through some wonderful scenery. From Donai it gradually descends to a bridge which spans the main nala ; after crossing this there is a steep ascent with several turns up into the Kalatope forest. The cliffs at this place rise to a very great height ; standing on the centre of the bridge and looking up they actually appear to overhang, and as the bridge is perhaps 200 feet above the water, the cliffs cannot be much under 1,000 feet from top to bottom. This is a really sheer drop, not merely a precipitous slope ; one often hears of so-called perpendicular cliffs of 2,000 feet and over, but it is difficult to conceive such a thing, and if they could be measured, it is probable they would be found to be much less. This part of the valley is exceedingly rugged and steep, everywhere stupendous cliffs and very steep hill-sides with little but grass on them. Along these cliffs are to be seen many "kart" or "tahr," and it is perfectly wonderful how they can dash along at the pace they do. Brown bears are also to be found in this valley, both in spring and autumn. Between Donai and Kilár there are not many ferns worth taking, except those mentioned above, and *Asplenium septentrionale*. After passing through the Kálatóp forest, where the road is steep, first up and then down, the Kilár bridge is reached. This spans the Chenab river (here known as the Chandra Bhaga). This bridge is the usual "sangla" of these hills, being built of wood ; the beams are supported by struts on either side, and it has a planked footway and hand rail. The span is nearly 200 feet, and the bridge is 120 feet above the water. These structures last very well for 10 to 15 years, but after that they become dangerous, the centre beams having sagged to such an extent that they have to be taken up and reversed. Before British officers came to Pangi the river was crossed by a "jhula" or twig bridge. A word of explanation as to the construction of these may not be uninteresting to such as have not seen them. In Pangi they are generally made of birch, cotoneaster and Parrotia ("killar"). They do not last

more than one year, and moreover require to be repaired after every four months. For a span of 200 feet or so the cost is Rs. 10 only, and the work of construction occupies fifteen men for a week. There are two methods of construction, one in which the guy ropes pass through holes in posts, and in the other they are taken over horizontal beams or logs about 2 feet above that on which the foot-rope rests. Three large ropes or guys are used, one in the centre, which forms the footway, and one on each side some feet above the first. These guys are connected by stays along their entire length, forming a sort of netting, which is not however sufficient to prevent a man falling through. The guys are made of green twigs plaited together in fours, forming a slender strand, and six of these are twisted together into a large rope, too large to be tightly grasped, so that one has not much hold on them in crossing; the foot-rope consists of five strands only. The twigs are gently heated to render them sufficiently pliant to be plaited properly together. One man puts the twigs together, another heats them, a third does the plaiting, and a fourth keeps it tight by means of wooden pins, at the same time stretching the rope as it is made. The large ropes are completed on the river bank, and then the work of getting them across begins. Men have to get to the other side of the river, and to do this they have often to walk miles up the river bank over most precipitous ground till they get to a crossing place. It is quite impossible to cross such a river as the Chandra Bhaga, through the water, not only does it rush along at a great pace, but the water is icy cold. Having reached the opposite side, endeavours are made to throw over a line to which the rope is attached. This is sometimes done by firing a bullet, to which a thin string is attached, but where no gun is available they have to throw, from both banks simultaneously, lines to which wooden grapnels are fixed and try to hook on in the water; having done this they proceed to haul the large rope across, and this has to be managed with great caution, only a short length being paid out at a time; if it were to fall into the water they could never haul it through the swiftly running river. Once landed, the guys are made fast separately round the nearest trees or large stone and securely fastened. The three ropes are then connected together with stays, and the bridge is finished. The whole structure has an airy, unsubstantial appearance, and crossing it is by no means an easy task; the footway is merely the large rope with no sort of staging of any kind, in fact the process is slack-rope walking of a very nervous kind, especially as there is a rushing flood 80 to 120 feet below. To

add to one's nervousness, the "jhula" has an unpleasant habit of swaying both up and down and sideways while being crossed, so that a very steady head is necessary to go across, and very pliant foot-gear, no one could do it in ordinary boots. From the bridge, the road is steep till it reaches a level with Kilár, this can be ridden, but most people would prefer to walk, as there is a very nasty drop towards the river.

Kilár is the capital of Pangi, to dignify it with a grand name, for it is merely a village, with the Raja's "kothi" and the forest house. The latter is a curious old patchwork structure, part being like a native house and part in English style. It is surrounded by very tall poplars, and has an excellent vegetable and fruit garden, especially one English apple tree, which now produces some hundreds of magnificent fruit. Hops were introduced into Pangi in 1880 and thrive very well, they are grown mostly in the Raja's land adjoining the kothi, but apparently the villagers find it is a remunerative crop, for they have taken to its cultivation in one or two places in the valley. The staple crops are barley, wheat and millet, &c. Indian corn is not grown, the snow fall interferes with its cultivation, and the bears do too much damage. Potatoes were introduced by English officers years ago, and are grown in many villages. The country immediately around Kilár is very bare and ugly, the only noticeable feature, close at hand, being a pretty grove of deodars. The view up the Chandra Bhaga is very grand, mighty snow-clad peaks in the distance, and in the foreground masses of dark stupendous cliffs. At the back of Kilár is a high barren peak, where marmots are to be found ; they afford a very good hour's sport with a rook rifle, and their skins are well worth the trouble of the climb.

Owing to the forests having been overworked in the dim past, there are very few mature deodar trees now left, and the future fellings will be limited to a few hundred once in every five years. Although there are not many trees fit for immediate cutting, still in thirty years or so the number will be very large, as the growing stock is in very good condition. The natural reproduction of deodar is excellent, since the Forest Department stopped the fires that used to be yearly lighted without any restriction. Some plantations have been made, but the valley is unsuited to artificial measures owing to the scanty rainfall, and the efforts made have resulted in failure, partly from this cause, but mainly from the unsuitability of the localities where the experiments were made, thus, in one place much time and money were expended on endeavouring to plant up a piece of old river bed, the soil consisting princi-

pally of sand and boulders. Owing to the cessation of regular working, no forest officer now lives at Kilár, nor is it likely there will be one there for many years to come, whatever works have to be carried out will probably be under the charge of a subordinate, supervised by the Chamba officer. The climate of Kilár (8,411 feet) is very mild in the summer, rarely rising above 80 degrees ; the rainfall is slight, not exceeding 30 inches, so that if the place were only more accessible to invalids, it would be well suited to them ; many travellers have likened the summer to that of England with the same softness in the air. Pangi used to be a regular hunting ground for ibex, and many English sportsmen came over in the spring, but the well-known places have been too much shot over, especially the once famous Tuan nala, and it is doubtful if an ibex with horns much over 32 inches could now be found. The Raja of Chamba has wisely closed this nala, for the present. There are however, many black and brown bears all over the valley, and as Pangi is easily accessible to sportsmen, more so than Kashmir, visitors usually find that even short leave of two months can be very enjoyably spent in tramping over hill and dale.

J. C. McD.

## CHARCOAL FOR GUNPOWDER.

ENQUIRIES have lately been made as to the possibility of making charcoal for gunpowder from Indian species of *Cornus*—dogwood.

There are three species fairly common in the outer hills of the Himalayas, namely, *C. macrophylla*, *C. capitata* and *C. oblonga*, but the cost of transport to the plains would be great. It would be an advantage if a good substitute for dogwood could be found in abundance in more accessible regions in India, and the subject is one well worthy of an exhaustive enquiry.

The following plants are at present in extensive use for gunpowder charcoal in India.

The common shrub *Justitia Adhatoda*, which is called baheker in the Punjab and bansuti in the North-West Provinces, is used for gunpowder charcoal in the Punjab.

Also the lower part of the stem or the root of *Calotropis gigantea*, a desert plant, is used to our knowledge in the Punjab. Colonel Drury, in his Useful Plants of India, in 1873, also says, page 101, that the root is used in the manufacture of gunpowder charcoal.

Next, it is said that the stalks of the cotton plant (*Gossypium herbaceum*) are also in use.

Lastly, we are told that the Madras Government Gunpowder Factory make use of the stalks of dál (*Cajanus indicus*), (kandi papu in Telugu and arhar dál in Hindustani.) The stalks are delivered at the factory with the surface well smoothened. Colonel Drury says, page 95, that *Cajanus indicus* stalks are used for making charcoal required in gunpowder manufacture (W. Elliott). Fire is also easily produced by friction from the dried stem.

In the above four plants we have thus inexhaustible material for the manufacture of charcoal for gunpowder. If any of them proves equal in quality to dogwood, there is no need for the latter.

This question should be decided by the gunpowder factories. It is not so easy to decide it elsewhere, because the manufacture of charcoal for gunpowder requires great care, the quality of the charcoal being very much influenced by the mode of carbonization and the temperature.

In England the chief woods used are the willow, the alder and what is popularly known as the "black dogwood," but which is really the alder buck-thorn, or berry-bearing alder (*Rhamnus frangula*), (Spon's Encyclopædia, page 882.)

The adoption of the above woods in England was no doubt decided empirically, for it is not easy to determine why any particular woods are better adapted than others. Though various other woods are used for coarse blasting powder, the three named are generally selected for the best gunpowders.

Small wood, of about ten years growth, is in all cases preferred for powder-making. Alder and willow of this age will be probably 4 to 5 inches in diameter ; dogwood about 1 inch. Alder and willow in pieces 3 feet long, not less than one or more than 4 inches in diameter. The wood must be straight, perfectly sound and entirely free from bark, and must have been felled during the spring of the current year. All wood is stacked on iron sleepers or on rows of brickwork. The dogwood is covered with straw thatching.

The wood is placed into sheet-iron cylinders, and these again into cast-iron retorts, three of which are heated together in a furnace. When clear carbon monoxide flame appears, the process of heating is stopped. The iron cylinders are taken out of the retorts and placed into iron extinguishers, in which the charcoal is cooled. The heating process lasts about three hours. Very much depends upon the temperature, so that even pyrometers are used for regulating it. Underburnt charcoal is highly inflammable. Charcoal prepared at 260° Centigrade ignites at 338° C., but if prepared at

982° C. charcoal ignites near 676° C. The more inflammable charcoal produces a more active or violent powder. Underburnt charcoal has, therefore, found favor for some small arms powders.

The following are analysis of several kinds of gunpowder charcoal :—

| | Ash. | C. | H. | O. with trace of N. |
|---|---|---|---|---|
| Alder, ... ... | 1·24 | 87·00 | 2·97 | 8·78 |
| Willow, ... ... | 2·02 | 85·82 | 2·88 | 9·28 |
| Dogwood, ... ... | 1·71 | 83·80 | 3·28 | 11·21 |

The average densities of these charcoals are respectively 1·37, 1·39, 1·30.

The analysis of the ash of each of these woods was as follows :—

| | Alder. | Willow. | Dogwood. |
|---|---|---|---|
| Silica, ... ... ... | 4·66 | 3·33 | 17·30 |
| Phosph. lime, trace iron, ... | 25·60 | 27·10 | 14·53 |
| Lime, ... ... ... | 24·90 | 27·66 | 31·60 |
| Magnesia, ... ... | 2·77 | 4·25 | 2·05 |
| Potash, ... ... ... | 10·53 | 11·50 | 8·20 |
| Soda, ... ... ... | 2·21 | 2·70 | 3·15 |
| Sulphur trioxide, ... ... | 1·20 | 2·50 | 1·22 |
| Chlorine, ... ... ... | 0·15 | 0·25 | 0·54 |
| Carbon dioxide, ... ... | 27·82 | 18·68 | 20·62 |
| Total, ... | 99·84 | 97·97 | 99·21 |

Experiments were also made (according to Spon's Dictionary) by mixing saltpetre and equal quantities of the charcoals of various woods which were burnt together. 12 gr. charcoal with 60 gr. saltpetre gave the following proportions of gas in cubic inches :—

| | Cubic inches of gas, *mean.* | | Cubic inches of gas, *mean.* |
|---|---|---|---|
| Elm, ... ... ... | 62 | Willow (*Salic alba*), ... | 77 |
| Oak, ... ... ... | 62 | Alder, ... ... | 74 |
| Mahogany, ... ... | 58 | Filbert, ... ... | 72 |
| Willow (overheated), ... | 63 | Fir, ... ... ... | 66 |
| Oak,... ... ... | 55 | Chestnut, ... ... | 66 |
| Buck-thorn (*Rhamnus frangula*), ... ... | 82 | Hazel, ... ... | 66 |

This last table shows that good charcoals are those which develop most gas. Beyond this no definite rules exist about the qualities of woods suitable for gunpowder charcoal. Only there is a tendency to younger wood and to shrubs. The latter particularly in India. It is, however, possible that amongst the enormous number of full sized Indian trees there may be one, or another, the wood

of which may be of excellent quality for making gunpowder charcoal. The necessity for enquiry seems certainly indicated. For the present a few woods have been selected at the Dehra Dun Forest School for experiments, namely—

*Adina cordifolia*,
*Randia dumetorum*,
*Gardenia turgida*,
*Butea frondosa*,
*Holarrhena antidysenterica*,

also charcoal from the species of *Cornus* already mentioned, is being prepared in Jaunsár, and specimens of each kind will be sent to the Kirki factory for report.

---

## TREATMENT OF BAMBOOS.

## TREATMENT OF BAMBOOS.

WITH reference to Mr. Mendes' note on the 'Reproduction of Bamboos' in the December Number, I should like to be allowed to ask him to give your readers some information as to the data upon which the seven propositions he has made have been based. I have read them over carefully, and have been particularly struck by his adoption of arbitrary figures, for instance—

*Proposition* 1. Why 25? why not 20, or 30, or any other number? and can he show that in any species with which he is acquainted, clumps of 7 years possess usually 25 halms. I imagine the species he is referring to is the *Dendrocalamus Hamiltonii*, the common bamboo of the Darjeeling lower hills, which, I believe, extends into Assam eastwards, but is otherwise only of very local importance. Has Mr. Mendes carefully planted this bamboo (or whichever one it is) and recorded his observations on the number of shoots sent up the 1st, 2nd, 3rd and subsequent years from definite experimental clumps? If so, the record of his observations would be valuable, and I hope he will give it us. It would be a valuable basis for working plan calculations if it could be shown that, *even on an average*, a 7-year old clump of a particular species may be expected to give 25, or any other number of full-size halms.

*Proposition* 2. Here again, why 8? why not 5, or 10, or 15, or any number up to 25? Why also should each stem be 7 inches in girth? What species does he refer to, and has he made any experiments to show that 7 inches is the average girth of mature halms of that species, measured at such and such a distance from the ground? I take it, 8 is the number arbitrarily suggested as being one-third of the number of halms.

*Proposition* 3. Here again, is it not intended to say 'one-third of the number of halms'? Has Mr. Mendes taken any steps to

estimate the 'average growth per clump per year,' by which I take it he means the 'average yearly increase in number of halms'?

*Proposition* 4. Does $2\frac{1}{2}$ feet in height correspond, in any particular species, to three nodes length? If so, in what species? The fact is, that in most bamboos I have come across, and particularly in *Bambusa*, the internodal spaces at the base are considerably shorter than those higher up, and very variable in their own length, and therefore to give the height at which a halm should be cut at so many nodes from the ground, would be liable to mislead. And why does Mr. Mendes fix upon $2\frac{1}{2}$ feet? I believe I have, myself, occasionally, arbitrarily fixed the height at which bamboo halms should be cut, at a maximum of 6 inches or 1 foot, I do not quite remember which, but my object was to secure *low* cutting, while Mr. Mendes appears to wish to secure *high* cutting. Can he tell us why he wishes to cut halms at above a cubit in height. I should have thought that such a practice would be rather wasteful, and would leave unsightly stumps to rot off and propagate fire when dry; but possibly he has good reasons for his views.

*Proposition* 5. Mr. Mendes is probably right in fixing three years of age as the maximum age for cutting, but it would be interesting to know what his reasons are; and also if he has really ascertained by observation that the cutting of the first year's shoots kills the clump, in any particular species. Sir D. Brandis, in a most useful note, incorporated under *Bambuseæ* in Hackel's account of the Grasses in a newly published part of Engler and Prantl's 'Naturlichen Pflanzenfamilien' says that "when one cuts away all or too many of the halms of a bamboo-clump the rhizome is weakened. It then brings out for a series of years, only thin stems, until continued activity has again strengthened the leaves," and this accords with my own observations, which in the case of *Bambusa arundinacea* are distinctly that when the whole clump is cut down, thin twiggy shoots only are produced for a year or two, but afterwards these get gradually stronger and eventually big halms appear again as before.

*Proposition* 6. This seems quite right, but the reasons should be given. The removal of dry stems and stumps will prevent fire doing more damage than can be helped; and will give space for new halms to develop in; besides making it easier to cut marketable ones.

*Proposition* 7. This too seems quite a proper provision.

The little piece of experience at the end of Mr. Mendes' letter is interesting, but it would be the more so if he could develop it and give an account of the observations upon which he based it. I am

inclined to think the generalization is rather hasty, and that there may have been other reasons for the better production of the planted clumps, such as better soil, more light, &c.

The fact of the matter is that the whole of our present knowledge of the life-history of the Indian species of bamboo, and of the sylviculture of the *Bambuseæ*, is very small, and we badly want experiment and the record of careful and protracted observation. I remember that, some years ago, under the orders of Government, at the time of the discussion of Mr. Routledge's proposals to utilize bamboo shoots for paper stock, two sample areas were planted at Bamunpokri in the Darjeeling Terai, one of *Dendrocalamus Hamiltonii*, the other of *Bambusa Tulda* (I think). Perhaps Mr. Manson, who did the work, took some notes on the development of the clumps which, I believe, reached working-size in about five years, and noted the number of shoots produced in successive years. At any rate I may suggest that, as Mr. Mendes is interested in the subject, he should ask permission to make a new experiment in a proper locality and record results. He cannot expect that any one should supply him off-hand with a set of definite rules for the management and working of clumps, to be applied to all species and generally. Even the three-years' rule would sometimes require to be modified, as, for instance, when the demand is for basket materials, for basket makers usually require young and comparatively soft stems to work with. It will be very useful to have the whole subject discussed in the 'Forester,' but it will be still more useful if those who have made definite observations and experiments will record the results statistically. The species which it is most important to observe are—(1), the male bamboo, *Dendrocalamus strictus*, of the dry hills of the North-West, Central and South India; (2), *Bambusa arundinacea*, the thorny bamboo of the valleys of the Peninsula ; (3), *Bambusa Tulda*, the common Bengal bamboo ; and (4), *Dendrocalamus Hamiltonii*, the common, but poor, species of the Eastern Himalaya.

KEW,
*12th January, 1888.*

J. S. GAMBLE.

## DATE CULTURE.

THE following is an extract from a letter by Dr. Bonavia to a friend in this country :—

"I am very glad to find that you have started experiments on date culture. Depend upon it a great deal can be made out of this tree, in

various soils and localities. It would be advisable to try some of the seedlings under various conditions—such as on the banks of canals and water-courses—on the edges of salt lakes, on drier irrigable land, and on dry unirrigable land; in order to ascertain what soil and conditions are best suited to it. Like all other fruit trees, it will bear a great deal of cultivation, and the more care is given to it, the better and larger the produce. In Egypt they manure largely with pigeon droppings, but any rotted manure will do. When the trees begin to fruit, manuring and care produce choicer fruit as might be expected.

"I have been exploring the literature of the date tree, principally in connection with its cultivation in Northern Africa. It is wonderful to see what has been done. All the information I have collected I have recently submitted to the Government of India. There is no doubt of success in many parts of India, provided the scheme is kept going for a number of years, and the interest in this important subject not relaxed. The point is to keep it going by the aid of Government sufficiently long to enable natives to see the result. Then they will carry it on without much supervision out of self-interest.

"It is marvellous to read what the Arabs and Berbers have done with this tree near the salt marshes of South Tunis and Algiers. Trees are to be counted there by millions, the people living upon little else than their fruit.

"In certain places they have to draw water by camel-power from wells of great depth, in order to irrigate their date trees.

"In Rájputána, I fancy in many places water is to be found at comparatively short distances from the surface. Near rivers, streams and tanks, the roots would soon go deep enough to be independent of surface water; but at first while the trees are growing, and until they are established, a good deal of care should be given to them.

"In Egypt, the date tree has been associated with man for upwards of 3,000 years, and it is wonderful to see how this tree has adapted itself to almost any soil and conditions. They have many varieties; some on dry soil, which is not irrigated; some on soils which are irrigated; and others on low ground, subject to Nile inundation. Some do well on sandy soil, and some on clayey soil, and so on—like the rice plant in India, cultivated from Ceylon and Burma, to the Himalayas and Afghanistan, owing to association with man from a very remote period; the date tree for similar reasons, has had time to adapt itself to various conditions—through propagation by *seed*. This appears the only way to get *new* varieties, that may be suited to different conditions. When India becomes well stocked with varieties of date trees, then there will be no difficulty in propagating only those which are best, by means of offsets.

"In correspondence with the Canal officers of Egypt, I have obtained a vast deal of information about the date tree, which I placed at the disposal of the Government of India.

"The Nile inundation lasts for three months or more, from beginning to end (commences in July—in September it is all over the country, attaining its maximum in Cairo in September, and early in November it is over). You see this is exactly the time between *setting* of the date fruit and *ripening;* and Egypt is then as damp as the rains in the North-West Provinces of India, so we must give up the notion that the date tree cannot succeed *except* in a *desert* climate. It should be noted however, that in Egypt, the fruit that keeps best after gathering is that from kinds that grow on high land, away from the Nile inundation. This is natural.

"But just fancy some kinds on the low lands doing well, with their roots under water for *70 days* without injury to the crop! From 20 to 70 days under water is ordinary, and some kinds do not produce well *without* inundation.

"There is no doubt whatever that *the varieties of dates are infinite,* and although it is only the choice and keeping varieties that are exported, *all* varieties are fit for feeding the people, either in their *ripe* state, or in their *unripe* state, and prepared in various ways.

"In their astringent state (red or yellow) and before they sweeten, dates in Egypt are sold in the bazaars and *eaten by the people.*

"So altogether this tree is a most hopeful one for the needs of India, not only in the drier, but also in the damper, tracts. I hope you will not drop the matter, as it is a very promising one. If it do not succeed in one place, it is a sign I think, that sufficient attention has not been paid to its needs.

"Where water is available, either in the subsoil or on the surface, it might do all over India.

"The best Egyptian dates are—

(*a*). *Ghazalee, Hayanee, Amree, Aklawee,* Bayd-el-Gamal, Binbaysha and Eglain; in the Sharkieh province (on dry land).

(*b*). *Samani, Zaglool* and *Halawa;* in Rosetta province.

(*c*). *Sultanee* and *Gunganee;* in Gabbari and Ramleh provinces.

(*d*). *Abreemee, Sukkutee* and *Goundela* from Sukkut, Upper Egypt.

(*e*). *Sewee,* from Sewa frontier of Bengasi.

"*N.B.*—The trees planted in the Sharkieh province, and that bear the best fruit, are on dry land, but there filtration of water to the roots is probable, as the roots go to great depths.

"Those planted in Rosetta, Aboukir, Ramleh and Gabbari, are all in a damp atmosphere, and damp soil, and *bear good qualities of fruit.*

"In Egypt, therefore, is a choice of varieties to suit all conditions of the various Indian climates both dry and damp, and I hope the Government of India may see fit to obtain also Egyptian variety of seeds. Regnier, in his observations on date cultivation in Egypt, says, the seed sometimes produces bastard varieties, but *more frequently pro-*

*duces* the parent kind. Of course the most certain way of reproducing the parent kind is by offset. That will come in due course, but at present variety and cheapness is of importance, and if done at all, it must be done largely and continuously for a number of years. The best way is to take nothing on trust, but to study the needs of the tree *in its new home*."

## THE CEDARS OF LEBANON.

THE grove of cedar trees on Mount Lebanon, which is mentioned in the Forest Flora of the N.-W. Provinces by Sir D. Brandis, was again visited in 1875 by Professor Dr. Fraas of Stuttgart.

From the town of Balbeck in Syria, with a temperature of 86° F. in the shade, he marched to the pass of El Adib, 7,825 feet above the sea, in the midst of melting snow with a temperature of 43° F. at 7 in the morning on the 23rd of May. Beyond this pass he came to the grove of cedars. The height of the grove above the sea is 6,332 feet, and the temperature fell in the night to 46° F., and did not exceed 68° F. during the day on the 24th of May.

The grove stands on the remains of an old moraine, which descended from the foot of Mount Makmel down the valley of Bsharreh.

Seven small hills of moraine débris form the site of the grove, which is quite isolated. With the exception of nine other solitary trees on adjoining ridges of glacial débris, there were near and far no other cedars, in fact no other trees nor shrubs, only deep down in Bsharreh cypress and poplar made their appearance.

The space occupied by the grove Dr. Fraas estimated at 25 acres. The total number of trees in the grove were 377. The largest tree stood along the rocky precipice of a hillock near the Maronite church. It measured 45 feet in circumference (at chest height). The traveller's tent stood beneath a tree of 30 feet circumference. There were altogether five trees with a circumference of 33 feet and more. The smallest trees had 3 feet circumference. A tree of 20 feet circumference had been killed by lightning, and on this tree Dr. Fraas counted the annual rings very carefully, and found 34 rings on 1-inch radius.

With this measurement as basis, the age of the biggest tree would nearly approach 3,000 years, and the five biggest trees would all exceed in age 2,000 years. The smallest trees would be 200 years old.

There are no young trees whatever, no advance growth. Dr. Fraas made a careful search for seedlings, but found none. Herds of goats which seek shelter under the cedars account for this. In the total absence of reproduction this last remnant of ancient glory appears thus doomed to annihilation. More than a score of stems show marks of lightning, and most of the large trees are severely damaged by the storms, and the trees are not as tall as they might be. One beautiful tree Dr. Fraas observed which was still perfect, 130 feet high, and containing altogether nine stories of branches. The last story was the well preserved top like an umbrella, not more in diameter than the base of the tree.

Foreign visitors have also damaged trees by cutting their names into them.

The local inhabitants would long have cut all the trees down if the very size of the trees was not a protection. It is beyond these people's power to cut such trees with their small tools.

A few isolated stems of other conifers are standing lower down as the solitary remains of demolished forests. These few trees evidently owe their preservation to their size.

Some oaks of 10 feet circumference remain standing for the same reason towards the eastern end of the Lebanon, where all younger trees are cut down.

In other parts of Syria the forests are likewise being utterly ruined by the cutting and mutilating of almost all trees. Dr. Fraas could not help attributing to this barbarism the complaints of the more and more frequent thunderstorms in winter and the increasing heat of summer.

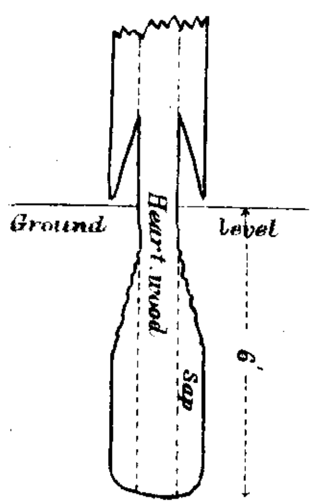
Dr. Fraas assumes also that there has been a general change of the climate which would prevent the future continuance of cedars in the Lebanon. We would not quite go so far. The climate is any how fit for the remaining cedars, and the absence of new trees has been sufficiently accounted for by Dr. Fraas himself. Further there is ample moisture, the snow having been 6 feet deep at the cedars in the winter preceding the visit. Moreover, the Lebanon rises far above the present level of the cedars, and situations with lower temperature are no doubt available.

We would, therefore, rather conclude that it only requires a period of peace, and preservation from goats and fires, and the cedars would spread again and flourish on Lebanon as of old. Solomon is highly esteemed by Mahometans, and some relic of the forests which furnished his magnificent temple should be as interesting to the Turks, as the tombs of their famous saints, which are so carefully preserved.

## DECAY OF POSTS AT THE GROUND LEVEL.

I HAVE just unearthed 20 posts from a bungalow, built 10 years ago, and find the portions below 2½ to 3 feet from the surface as a rule quite good (even the sap-wood).

The decay at the ground line is so uniformly of the same character, that I forward an outline in case it may be of use in assisting towards an elucidation of this curse. Some few posts of ajhar (*Lagerstrœmia Flos-Reginæ*) I find almost quite sound, and saw a case lately where an ajhar post, about 4½ feet girth, was absolutely sound to the very surface, all through round at ground, though it had been in for 19 years.




The peculiarity generally is that below 2½ to 3 feet the posts are generally quite good, even if of sap-wood of nahor (*Mesua ferrea*), why is this?

I have had some considerable experience in *re* posts, but have never been able to understand why even the sap-wood lasts below a depth of 2 or 3 feet, in a few cases the heart-wood was decayed at ground level, and sap-wood below quite intact. Can any of your scientific readers throw any light on the peculiarity, which is one that interests so many.

Neither kerosine, or petroleum, both of which are good for preserving upper work in doors, are of any use apparently at ground level, and packing round the foot with charcoal equally useless; sand ditto.

A white, thread-like, mycelium seems to infest the decaying portions, but why it should spare the part above ground, when it luxuriates among our tea tree stems, exposed to weather and *sun*, is an anomaly. I enclose some of the threads referred to.

*Naharani Saw-mills,* S. E. PEAL.
*Sibsagar, Assam.*

It is probable that at a certain depth below the surface, the mycelium of the fungus which destroys the wood cannot grow, for want of oxygen, and perhaps of sufficient humidity.

Above ground, it is probably killed by the heat of the sun and by exposure to the drying influences of the wind and air, which are less effectual amongst the crowded tea bushes.

The mycelium will be sent to Mr. Marshall Ward of Cooper's Hill College for inspection, and if Mr. Peal could forward complete specimens of wood attacked, and fructification of the fungus to that gentleman, and also to the Director Forest School, the nature of the fungus could be studied.—[ED.]

## MAGNESITE AT MUSSOORIE.

I HAVE just visited the locality near the Happy Valley in Mussoorie, where magnesite occurs, and found three out-crops 4 feet thick, a mixture of a fine white powder and of coarser rock. The two can be separated by washing. I obtained 20 per cent. of the coarse rock, which is a dolomite containing about equal quantities of magnesium carbonate and calcium carbonate. The white powder amounted to 80 per cent., and by chemical analysis I found it to be composed as follows :—

| | |
|---|---|
| Silica, &c., ... ... ... ... | 6 |
| Alumina, ferric oxide, &c., ... ... | 3 |
| Calcium carbonate, ... ... ... | 7 |
| Magnesium carbonate, ... ... ... | 84 |
| Total, ... | 100 |

This is much purer magnesite than the specimen which I obtained in 1884, and of which an analysis was published in the "Indian Forester," March 1884. The vegetation prevented me from making a more extended examination, but as the out-crops look like the ends of a regular seam, there promises to be a sufficient supply for the requirements of a manufactory of wood pulp.

H. WARTH.

WE understand that a Conference is to be held at Delhi, at the end of this month, to decide the future organization of a Veterinary Department to deal with cattle disease, which has been so prevalent in the north of India. The question of the extension of the utility of the Dehra Dún Forest School will also be discussed.

# IV. Notes, Queries and Extracts.

## FOREST PRESERVATION.

MR. H. G. Turner, Agent to the Governor in Vizagapatam, in his remarks on the water-supply of the Vizagapatam district, in his report on the administration of the agency tracts during the year 1886-87, writes :—*It* is a remarkable fact that there is so much misapprehension on the subject of the rise of rivers. Over and again it is stated that brooks rise on the sides of the hills. This was, and possibly still is, one of the many dogmas of the Forest Department, who perpetually implore Government and harangue the public on the folly of cutting down trees on the side of hills because the, water-supply of the country is thereby imperilled. Now the sources of rivers are not to be found on the sides of hills. Springs do not gush out of the hill-side, like in the picture in the Family Bible which shows a fountain of water springing forth from the rock at the touch of Moses' rod. There is not in the hot weather a single spring of useful dimensions, issuing from any hill-side, in Southern India. Nor is there a congeries of such springs whose united flow forms the head of any river south of the snow-fed rivers of the Himalayas. The sources of all rivers in Southern India are on plateau and in long sloping valleys and swamps ; and river water is the gradual off-flow of the rainfall of the country If all the plateau and all the valleys in Southern India were tilted up at an angle of 45 degrees, there would not be a single perennial river in the Madras Presidency. To imagine that rivers rise on the sides of hills is equivalent to a declaration that the sloping roof of a house forms an admirable reservoir. The truth is that a hill-side covered or uncovered with forest is about the worst receptacle for the retention of water that can be imagined. If the forest be cut down and the earth turned up for cultivation, water may penetrate, and doubtless does reappear in the form of springs further down. But all this source of supply is exhausted long before the hot weather sets in, and perhaps in February, certainly in March, miles and miles of forest may be traversed without seeing a trickle issuing from the hill-side. This statement is sure to be contested, but I am prepared to illustrate the truth of my assertion by reference to the head waters of the Saveri, Sileru, Cauvery and Perjar, with all of which I have some actual acquaintance. I may say that years ago when I ventured on these views in the presence of Dr. Brandis, he was so struck with their importance, that he proposed to form a committee to test their truth. Nothing was done, however, and people still go on repeating the same old saws, about springs gushing out of hill-sides and of the necessity of preserving the jungle in order to protect water-supply. From that time to this I have never failed to take note of these phenomena, when I have been in the jungle, and everything I have seen confirms me in the accuracy of the observation. I mention this matter here for two reasons : one is that I impress my views on every forest officer I come across, and I trust that I am gradually disseminating a propaganda of disbelief in the older tenets of that department ; and secondly, because I want to prevent this reason of protecting water-supply from being brought forward to justify restriction in the matter of the hillman's hill-side cultivation.

Above we reproduce some remarks by Mr. H. G. Turner, Agent to the Governor in Vizagapatam, on the water-supply of that district. It is possible that the printed statement may do less than justice to the report. It is also possible that the report may do less than justice to Mr. Turner's opinions. But taking the statements as they stand, it appears that the Forest Department is charged with the entertainment of certain peculiar views regarding the sites of springs and the *consequent* necessity of preserving hill-side forests. Hence we may profitably briefly indicate the *rôle* of a forest department.

A forest is a collection of trees, but it is something more. In an old forest we have overhead a leafy canopy. Underfoot we have various vegetable growths. This undergrowth is to the earth *what the skin is to the human body.* The trees rise from this skin like hairs from the body. The skin is composed of shrubs, mosses and grasses. Under this growth is a rich mould which represents the accumulation of centuries. We could sweep it away in a week. No skill could reproduce it in fifty years.

When we lay a seed in suitable soil by-and-bye there comes up a plant. When this plant has put forth leaves and has grown to its full size, from where has it obtained the material for its growth? Is it that the roots suck nourishment from the soil and send up all necessary material in the form of sap? By no means. A large proportion of the new material comes out of the skies. From the air is obtained a quantity of water and a quantity of carbon dioxide. This latter is the gas frequently called carbonic acid. The carbon dioxide is decomposed and the carbon is built up in the tissue of the plant. Liquid water is, so to say, solidified and forms another portion of the tissue.

After a time this plant dies and even while it was living its leaves may continually have died and fallen to the ground. When the plant is wholly dead its past history, so to say, lies around its former home. We are here supposing that the relics are not scattered by wind or by other agencies. The soil now may have more collectively in it and upon it than it had before the plant was sown there. Among these relics we may sow another seed. This in time will give a plant which does indeed to some extent find food in that mould of relics. But also it lays the air under contribution, and is fed by the rain that falls there, or the vapour that comes with the air. When this second plant has wholly died, its relics are added to that portion of the former relics which was not by the second plant absorbed and built afresh into tissue. After many generations of plants have lived and died on that spot of ground, it holds

the tribute received from cubic miles of air through long spaces of time. Such is the history of the soil over which we tread as we wander through an ancient forest. There is old age in the massive trunks, but there is old age likewise in the soil that sustains them.

In similar way, on a coral island in the Pacific there is at first a tiny accidental growth of vegetation. By-and-bye this is multiplied, till we find a fertile island fit for the abode of man. Thus also in the desert of Sahara let us bring water to the surface by means of an artesian well. By-and-bye we have grasses and a row of date palms. These date trees are not transmuted sand, they came from the winds of heaven.

Let us suppose ourselves to do what savages or thoughtless pioneers have done, in many lands—let us visit an old forest and cut its patriarchs down. Now let a heavy rain descend on that mould of ages. It is carried down to rivers or scattered far and wide over lower lands. That mould was potential wealth—that wealth exists no longer.

On the other hand, let rain equally sudden and equally violent descend on an old forest. Much will have fallen before the ground below has become appreciably wet. After the leaves have received as much as they can hold, the soil will begin to get droppings. The water thus gently falling from the height of the lowest leaves will not disturb the arrangement of the mould. This mould will act like a dry sponge absorbing and accumulating in its interstices a great mass of water. This mould in turn holds up the water so that for a time nothing finds its way to the lower lying strata. Frequently all the water that has fallen will be lodged and retained in the mould. There it can remain a considerable time, as the evaporation will be slight. Meanwhile, the grasses, shrubs and the great trees will be feeding on this water. Thus the mould acts as a treasure house or reservoir. But if such a heavy shower were to fall on open land most of the rain may run off before the vegetation has had time to make proper use of it, and, in so running off, it is not only useless, but injurious, as it carries good soil along with it. Especially is this likely to happen if the open land is on a hill-side.

In a country like India we may have months of dry weather, and then the rain comes down as if all "the waters that are above the firmament" had decided to stop there no longer. If these waters, which are above the firmament, could be arranged in the manner of a shower-bath—ourselves to pull the string when so it pleased us—then forests anywhere, and especially in countries like India, would lose one of their recommendations. Here we have

only been thinking of forests as modifiers, distributors or reservoirs of moisture. In some of the States of North America the early English settlers cleared off the forests with such thoughtlessness, that now for the manifold wants of their thriving communities they have to import timber all the way from Canada. Probably these are some of the truths that the Forest Department are preaching in Vizagapatam.

Let us now consider the question of the site of a spring. At one of the highest points of the Brocken, which is the topmost peak in the Hartz Mountains, there gushes out a spring called the "Sorcerer's Spring." It is so called because its appearance there suggests some sort of magic. The wonder is where the water comes from to supply its unceasing flow. The explanation is that the mountain is crowned by a plateau. The highest point of this plateau is about twenty feet above the spring. When the extent of this plateau is considered and the quantity of rain that falls on it is calculated, it is found that the rainfall is more than sufficient to supply the outflow of the spring.

This spring is exceptional in its position, but it is mentioned here as a caution against the dogma that springs *never* rise out of hill-sides.

Let us for the general case consider rain falling over a large extent of mainly open country. All that the vegetation and topmost soil does not at once absorb sinks to lower strata. As long as these are easily permeable the water continues under the action of gravity to work towards the centre of the earth. At last the water reaches some water-tight stratum, and then its course must change. This stratum will not be a perfectly level plane, but it will have crumples or folds—though these may be only slight—and will in some direction slope downwards. Along this downward slope—which again may be slight—the water will run. As it runs it will chiefly collect in the folds or channels, and these channels will run into each other. Thus we have a subterranean system of streams, all running it may be finally into one main stream. If this impervious stratum somewhere strikes the surface of the earth, then at that place—called the outcrop of the stratum—the water will gush forth and we give it the name of a spring.

The water in its course to the spring may have ups and downs. All that is necessary is that the spring itself shall be at a lower level than some other parts of that water-tight or impervious stratum. Whether this outcrop of the stratum happens on a hill-side or happens in a valley between two hills is—so to say—an accident.

Let us for a moment imagine that the spring rises out of a hill-side and let there be a small forest round the spring. Then the outflow of that spring is only slightly influenced in any way by that forest, for the spring may drain a thousand square miles of the earth's surface while the forest may be less than ten square miles in extent. If a forest department took to protecting that forest it would not be with the chief object of preserving undiminished the outflow of that spring.

As another case, let us suppose a couple of long hill ranges with a valley or system of valleys between them. Let us imagine that the water-tight stratum crosses these hills passing under the valleys —not striking anywhere in the neighbourhood the surface of the earth. Then the rain that falls and sinks into the ground on those hill-sides which face the system of valleys will tend to run into the valleys. The water thus forms a curved sheet following the indentations of the water-tight stratum. In the valleys the upward pressure of this water thus resting on the impervious stratum becomes great, as it has what engineers call a head of water. Suppose that somewhere in one of the valleys the ground above the water-tight stratum is easily penetrable by the water. Then the water will well up there, and though it may begin with a small opening, it will gradually enlarge it by the mere mechanical action of the water. In this case we have the spring site in a valley. The lower the site where the water finds its way back to the earth's surface the more abundant the flow is likely to be, because the extent of earth surface thus drained is likely to be larger. Such a spring is also likely to be more constant in its flow, for though there may be dry weather over one part of the thus drained earth surface, heavy rain may be falling elsewhere, and so keeping up the average.

Lastly, suppose that in the valleys between these hill ranges there is no one small spot of earth below which the ground over the water-tight stratum offers an exceptional facility to the upflow of water. But let there be a somewhat considerable extent below which the soil or the rocks are all equally and moderately pervious. Then the water will tend to escape upwards through this extent of ground, and we have perhaps a lake formed. If the outflow of water is less considerable, or the evaporation is great, we may only have a marsh or swamp. In this latter case there is no reason why the ground should be nearly level.

If, however, the forest is comparable in extent with the country drained by the spring, then the value of the forest in sustaining and equalizing the flow of the spring has been proved beyond all question. Especially is this the case when the land is on a slope.

As regards the statement that a "hill-side is about the worst receptacle for the retention of water that can be imagined," it may be sufficient to mention that on the peaty mountain slopes of Ireland and Scotland there are lodged at the present moment some millions of tons of water.—*Indian Engineering*.

---

IN THE HIMALAYAN COUNTRY.—The country of the outer Himalaya—the tracts which form the base of the vast triangle which has the isle of Ceylon at its apex—is the most charming for climate and the most surpassing for grandeur and beauty of scenery of all the districts, countries, and places of India. The writer is familiar with but one part of this long line of territory, and of that part he takes up his pen to give some account; but he believes that he may say with correctness that there is vast similarity everywhere along the great wooded base which looks down on the plains of Hindustan, in front of the eternal snows, from the Punjab territories, far to the left, to Darjeeling and parts adjacent and beyond, away to the right. You have the same sanatoria for British soldiers; hill stations for the European community generally, which vary only as one English town differs from its neighbour; and nestling in nooks all over the hill-sides, you have the same sort of native inhabitants, semi-Hindustani or Indian and semi-Mongolian in national type.

Of late years, the most notable movement in these mountain districts has been the establishment of the Forest Department by the Government of India, which has, by the hands of this department, assumed formal possession of all the great forests; has set about taking care of them; and, further, of multiplying and increasing both the area and the best natural products of these enormous and majestic wildernesses. Noble are the mightly hill-sides, indeed; and in the verdure with which they are clad may be counted many varieties of pine and classes of kindred genus. The deodar, which we believe is a cedar, is esteemed the most valuable. In the hill-tracts which face the upper provinces of India, the mountains generally are wooded only on the sides looking backward to the higher ranges, the snowy chain behind; and the slopes which look south, to the sun, are yellow and bare. At points along the line of railway which runs for many a hundred mile from Calcutta in the south-east to far-distant Peshawar, right on the distant verge of empire, one can alight to go to the hill station of his choice or to which duty draws him. Darjeeling, which is now a great place, can be reached from Calcutta direct; and by going

up the line, one can alight for Naini Tal or Mussoorie, for Dalhousie or Simla ; but to get to these places, after leaving the main line, one must undertake a second journey, which varies in length and in difficulty with the station selected. But refreshing it is, when you *do* get there, and you can appreciate then what 'climate' means ; and you are apt to go about enjoying each mouthful of the fresh air, with hands extended, as if to grasp and weigh and feel the delightful commodity.

The climate would be considered good and bracing for any country in the world ; and the Forest officers are quite appreciative of the great advantage that in this respect they enjoy : and they cling to the hills, although, as compared with some other departments, the Forest is not well paid ; while the life is often one of complete isolation. The Forest officials have rather a difficult course to steer in their dealings in the way of duty with the native communities of the hill-side and the glen. The villages are legion ; they are scattered about everywhere, and they have, the writer infers, many claims, coming down probably from unknown antiquity, which are apt to clash with the great claim of imperial lordship. But the department appears to be very wisely guided ; and the officials are trained men, not rarely of high scientific attainment ; learned in all native languages, and in social position equal of course to any. Jolly little cribs some of the forest huts are, and in much, very un-Indian like ; but covered with trellis-work and creepers, half hut, half bungalow, they carry one away from things Indian, especially when the sun is sinking low behind the great mountain walls, and the air is getting chilly, chilly. Very pleasant then to turn inside, where the little room is ruddy with the light of the roaring fire. On the sward near the house you may see, too, English daisies; but *they* do not come naturally ; for if they exist, they are due to the horticultural tastes of the officer of the circle. The villages are low in the interlying valleys, but sometimes on the slopes of the hill. Some look like a collection of Swiss cottages, two-storied and roofed with slate ; and Swiss or not, certainly unlike anything in the lower regions, 'the plains,' from which we have just ascended.

In one large village which the writer visited, he was struck with the fine appearance of the female community. They looked far finer beings than the men, and were full in form, with remarkably large and expressive black eyes ; and, generally, buxom of figure and expressive of face ; while the men appeared very ordinary, thin, and shabby creatures.

Another charm of 'the interior'—as the regions lying away

from the hill stations are called—is the pheasants. Here you get the noble birds amid the noble forests. There are several varieties, but the most prized is the *moonal*, which is got at the highest elevation, and whose coat is of a beautiful azure. You may be 'worse off,' indeed, than to be wending your way home to the hut carrying a heavy pheasant, which you have just bagged on the soft grassy brow of some great declivity; turning, now and again, to look at the sunset light still welling up from the sable deeps of the opposite ranges; and then feeling the frozen ground of the forest path crunching beneath your feet; while your retriever comes pattering after you.

There is other game than pheasants on these alps, however, very different; and the pursuit more arduous. Bears abound, and *tigers are at times very troublesome.* The bear, although not fond of showing fight, can maul most frightfully with his claws, which resemble those of a garden rake, and his favourite *coup* is to scalp. Mr. P——, a Forest officer, lost his life by a fall from a precipice in an affair with a bear; and as to tigers, our host at Deoban, Mr. S——, was the lucky man who, a few years ago, killed a man-eater, for whose destruction the whole station of Chakrata turned out, soldiers, civilians, and all, a comprehensive line; and the animal fell to the rifle of Mr. S——. In a jar of spirits in the bungalow some human remains are shown that were found in the stomach. Close to Deoban, Mr. G——, of the Forests also, a noted sportsman and shot, while walking along, heard some noise behind him, and discovered that he was being followed by a tiger. He signalled to his servant to hand him his rifle; and returning towards the striped animal, he 'let him have' a bullet in the head, and 'bagged' him; the shot being as accurately placed between the eyes as if done by a pair of compasses!*

In the winter-time, the writer has seen the icicles hanging plentifully, long and solid, from the eaves of the Deoban bungalow, the snow lying deep everywhere, and the vast woods shrouded, silent, in the soft ghostly garniture. This spot is some 9,000 feet above the sea; and after a stormy night, the writer has seen the clouds lying like a great calm sea *below* one, with here and there the tops of hills for islands. The *coup d'œil* was superb and enchanting: the millions of surrounding trees mantled in saintly snow: below one's feet, the floor of cloud, 'vast—motionless'; far away, the white bulwark of the eternal snows; and over all, in exquisite contrast, the pale blue of the sky, with the sun as yet

* This did not happen near Deoban but in the Bhagaratti valley.—[ED.]

unrisen. Such a scene is not often beheld, and forms a diamond locket for Memory to keep with her.

In the summer, which is always pleasant in these altitudes, wild strawberries patch the sides of the hills with red. Eaten 'one by one,' these have not much flavour; but munched by the handful, they do give out some characteristic relish, albeit a faint one; and they make very nice jam. Apricots are grown in the native villages, and these, too, are better as jam than eaten from the tree. Rasps and blackberries can also be gathered; and the writer remembers gratefully the confections made by a lady-friend resident at the neighbouring military hill station; and all made from native fruit, supplemented by perhaps English strawberries. In the military station, in cantonments, you might well forget India, for everything looks so English. Neat brick buildings of all sizes, with slated roofs; brisk, stalwart redcoats; neat young English women passing by; and in the gardens below the railing-lined walk, little fair-haired English boys and girls laughing and playing. And the fresh, glorious air, how it comes in billows up the wide steep ravines, with the diminished trees and villages far away down! And looking level, you feel the sensation of being up in a balloon! Here the newly arrived regiments are sent when just out from England, to be 'set up' by a year's residence, ere going to their long spell of duty in the hot plains beneath. And the English look, mostly, as if the place did them good; and you may see as healthy visages and as rosy cheeks here as you could wish.

To revert to the strawberries. The writer recalls a time when he went strawberrying with the help of all his baggage coolies, to gather for jam-making; and how a favourite dog, Sancho, a water-spaniel, was as keen after the berries as any, and would hunt for them in company of his master, and with roguish delight would seek to be first at a good one, pouncing upon it with his paw; and with waving tail, and the white of his knowing eye showing, refusing to let go! A hill pony that had been for years in the plains enjoyed himself, too, on another occasion; and when he came to a stretch of snow lying by the roadside, would delight to go among it and to toss at it with his nose as he trotted through it. It is requisite in these parts to have horses that are accustomed to the hills, for animals coming up freshly are apt to get terribly puffed and blown with but little exertion. Ponies are preferable to horses, but the latter are extensively used. Not far from the cantonments of which we are writing is the spot where, in the year 1871, Captain Lillingston of the Forest department lost his life by his horse's foot slipping. He fell, not over a sheer precipice, but

down a long grassy bank ; and was found dead at or near the foot of it ; and the horse too. A simple stone with an inscription and I.H.S. marks the place on the path by the lone hill-side.

One branch of the work of the Forest department is the cutting of sleepers for railway purposes, and the floating of them down the streams that wind towards the plains at the bottom of the ravines in the mountains. The deodar cedar is the best, we believe, for sleepers. This is a most important part of the department's operations. Another is to supply the cantonments with firewood ; and lastly, it devolves upon them to offer a great deal of general hospitality, which they obligingly do, and at no small sacrifice, for many are the calls upon them, both upon their time and their cellar and larder, by friends well known and by the passing stranger.

It is a grand mountain country. The scenery is of great beauty and grandeur ; often more bare and bold than beautiful ; yet in the aspects facing the north, where the trees abound everywhere, one finds scenes of singular nobility ; and on most days you can get a view of the higher monarchs, the eternal snows. These, however, are distant, and not, therefore, so imposing as imagination will figure them, and the snow appears at times as of a metallic tinge. But it is grand, nevertheless ; and the air cold, bracing, glorious. Lovely are the pinewoods when the late afternoon sun is lingering among them ; and the high bank where the wild thyme grows, on the misty morning when the sun is slowly climbing up from the east, there is health and pleasure and poetry there too ; as there is when the aromatic scents from the forest side steal over one like soft and subtle music.—*Chambers's Journal.*

---

THE FORESTRY OF WEST AFRICA.*—This, as its title indicates, is intended to form a hand-book to the economic plant-products of Western Africa. Although the author is Governor of a British colony in this region, his remarks are by no means confined to British possessions, but are intended to include all that is at present known of economic interest connected with the plants of Western Tropical Africa.

Following Prof. Oliver, the author deems it expedient to divide Western Tropical Africa into two principal geographical regions. The first, called Upper Guinea, includes the western coast region

* Sketch of the Forestry of West Africa, with particular Reference to its Principal Commercial Products. By Alfred Moloney, C.M.G., of the Government of the Colony of Lagos. (London : Sampson Low, Marston, Searle, and Rivington, 1887).

from the River Senegal on the north to Cape Lopez immediately south of the equator; the interior drained by rivers intermediate between these limits, and the small islands of the Gulf, Fernando Po, Prince's Island, St. Thomas, and Annabon. The second region, called Lower Guinea, includes West Tropical Africa from Cape Lopez southward to the Tropic of Capricorn, including Congo, Angola, Benguela, and Mossamedes. Within the limits here indicated we have British possessions represented by "colonies" and "protected territories," and we have numerous possessions claimed by the French, Portuguese, Spanish, and German Governments, some of which have only lately been acquired in the European scramble for African territory. It is only right to mention that the term "possessions," as here applied, is somewhat a misnomer. There is little practically possessed, even by ourselves, except a slender coast-line: the interior is described as having no "territorial definiteness," and it is politically, no less than scientifically and commercially, unexplored. Capt. Moloney has wisely not attempted to treat separately of the economic products of these possessions. He has taken their present economic botanical productions in order of export value, and we find that these consist chiefly of palm oil, ground nuts, india-rubber, coffee, gum, dye-woods, cacao, cotton, fibres, and timbers. Palm oil, the produce of *Elæis guineensis*, a plant which covers immense tracts of country in Western Africa, is imported to this country to the value of nearly a million and a quarter annually. The yellow palm oil is obtained from the outside fleshy portion (sarcocarp) of the nut, while a white solid oil is obtained from the kernel. India-rubber is another West African product obtained chiefly from climbing vines belonging to the genus *Landolphia*. The author was one of the first to draw attention to the value of *Landolphia owariensis* as a rubber-plant, and it must be gratifying to him to find that the exports of "white African rubber," as the produce is called, have during the last four years risen from almost nothing to a value of nearly £36,000. What is know as "Yoruba" indigo, derived from a large tree, *Lonchocarpus cyanescens*, has evidently a commercial value, but at present it is used to mix with butter or "shea" to make the negroes' hair a fashionable gray!

Numerous West African plants are cited as yielding either gum tragacanth, copal, frankincense, gum-arabic, bdellium, or resin; what is called "ogea" gum, derived from an unknown tree, *Daniellia* sp., is used powdered on the body and as a perfume by women. The true frankincense-tree of Sierra Leone is *Daniellia thurifera*. Camwood, used largely as a dye, is derived from *Baphia*

*nitida;* but although barwood is generally said to be derived from the same source, it fetches only one-sixth the price of the former. The medicinal properties possessed by numerous West African plants is a subject full of interest.

Various species of *Strophanthus*, the active principle of which was formerly used for poisoning arrows, and is known to be of incalculable benefit in cardiac diseases, and the merits of the "miraculous berry" (*Sideroxylon dulcificum*) of the Akkrah and Adampe districts, which is credited with rendering the most sour and acid substances "intensely sweet," and of the "oro" plant of Sierra Leone, said to act as an irritant poison cumulative in its effects (which has been ascertained at Kew to be a species of *Euphorbia*), are among the numerous subjects requiring further investigation.

A most cursory glance at this book cannot fail to suggest the wonderful wealth both of botanical and industrial problems which are yet unsolved in connexion with West Tropical Africa. The "Flora of Tropical Africa," by Prof. Oliver, of which three volumes are published (the last in 1877), has made a beginning in the work of elucidating some of these problems; but in recent times few men have systematically pursued West African botany, and the entire absence of a resident botanist or of a properly-equipped botanical establishment in any of our West African colonies has left the plants of a most important region to be known only by the intermittent collections of travellers who have either perished there before their mission has been completed, or have hastened home to avoid the effects of the deadly climate.

Nearly 200 pages of Capt. Moloney's book are taken up with condensed notes and references to the economic plants of Western Africa arranged in natural orders according to the "Genera Plantarum" of Bentham and Hooker. To many people both in West Africa and at home these notes, brought together by the assistance of an officer connected with the Kew Museums, will prove of great value. In the appendices are given a copy of the instructions for collecting plants, seeds, and useful plant-products issued by the Royal Gardens, Kew; an ornithology of the Gambia, by Capt. Shelley; a list of Coleoptera and of diurnal Lepidoptera of the Gambia, by the same writer; and a list of reptiles, batrachians, and fishes collected at the Gambia by Capt. Moloney in 1884-85.

The book is well got up and clearly printed, but it has the unpardonable defect of being published without a good alphabetical index. This greatly detracts from its value as a book of reference.

It, however, is the chief fault we have to find with a work full of interesting matter for the first time brought together, and evidently prepared with great care.—D. M.—*Nature.*

---

THE ANNUAL FLOODS IN THE PUNJAB.—The 'Pioneer' has reviewed our February paper from "Indian Engineering" on the effects of irrigation on the recent excessive falls of rain in the Punjab, and as we thoroughly agree with the conclusions arrived at, we republish the articles for the benefit of our readers.

"The floods which have several times within the last three or four years breached the North-Western Railway in the neighbourhood of Umballa, thereby cutting off Simla for a time from postal communication with the outer world, have been generally attributed to the reckless denudation of the lower hill ranges between Simla and the plains. This view has of course been maintained, and the proper remedy pointed out and insisted on again and again by professional foresters; yet in a spirit of fairness, which cannot be too highly commended, the 'Indian Forester' for this month quotes from a professional engineering paper an article by Mr. J. E. Hinton, C.E., which maintains that the 'true cause' of these floods is to be found in the newly irrigated lands of the Sirsa district watered by the Sirhind Canal. The editor of the 'Forester' makes no comment on Mr. Hinton's article, probably thinking that his statements and the figures advanced in their support carry to professional readers their own refutation. Briefly stated Mr. Hinton's calculation is this: taking 1,000 square miles in the neighbourhood of Sirsa, of which about 1-400th part is under daily irrigation in the hot season just before the rains, and assuming that the evaporation from this is one-fifth of an inch daily (about twice the average rate, but probably not too much for June), we get a million cubic feet of water daily added to the over-lying atmosphere, which, when rapid transportation by the hot north-west winds comes to an end, will speedily saturate the over-lying atmosphere, say to the height of a mile. Supposing these 1,000 cubic miles of saturated air to be carried by south-west winds to the outer Himalayan ranges, and to have the temperature there reduced 10 degrees, the result will be a precipitation of 70,000,000 cubic feet of water, or thereabouts—surely sufficient to give rise to a disastrous flood, so it seems when we speak in millions. But if we inquire how much rain this means when measured in the ordinary way, we find that 70,000,000 cubic feet spread over 1,000 square miles of country mean only 0·03 inch of rain—barely sufficient to lay the dust!"

---

"The actual quantities of water involved in a downpour giving rise to a big flood are so enormous, that the evaporation from all the irrigated

land in India is a negligible quantity in any investigation into their origin. Thus on two occasions last year the rainfall over the eastern half of Dehra Dún, the Siwaliks and the Nahan hills to the west, exceeded 10 inches in 24 hours—once over a great part of the region, which is much more than 1,000 square miles in area, it was nearer 20 than 10 inches. But 10 inches of rain over 1,000 square miles is 23,233,000,000 cubic feet—a quantity incomparably greater than any result of local evaporation, and capable of producing most disastrous floods if allowed to run off directly into the drainage channels. On the Punjab side of the Jumna such a free course is provided by the denudation of the lower hills. The railway, therefore, gets breached almost as regularly as the rainy season comes round, and in some districts, like Hoshiarpur, the fertile lands of the plain are being smothered under the sands brought down from the poorly consolidated tertiary rocks of the outer hills. On the Saháranpur side of the river we do not hear of such floods, though the rainfall on the Mussoorie Hills, Dehra Dún and the Siwaliks is usually much heavier than to the westward, simply because the soft sandstones of the Siwaliks are carefully protected from denudation by a belt of close forest. Heavy downpours over this region in the month of August have been unusally frequent, it is true, since the opening of the Sirhind Canal; but *post hoc* is not always *propter hoc,* and of the cause of this frequency nothing whatever is known. Every season has its own peculiarities, and each year the heaviest rain has a tendency to recur in particular localities. Some years the region of heaviest precipitation is in North Bengal or Tirhoot, at other times it is Rohilkhand, and this year it happened to be the Upper Doáb and Dehra Dún. But when the heaviest rain falls in the normally moister regions to the eastward (where there are no canals), much larger amounts are not uncommonly recorded, for example over 36 inches at Purneah one day in 1879, and over 34 at two places in Rohilkhand in 1880."—*Pioneer.*

---

Reclamation of Usar Lands in Berar.—We extract the following from the Annual Report of the Agricultural Department, Bengal, for the year 1886-87 :—

"Having noticed in the 'Indian Agriculturist' that Mr. Maries, Superintendent of Gardens of the Maharajah of Durbhunga, had succeeded in reclaiming lands impregnated with saline matter by planting certain trees upon them, a letter was addressed to him, asking for further information on the subject. In reply, Mr. Maries wrote as follows :—

"'When I came to Durbhunga six years ago, I was much troubled to know what to do with certain patches of saline soils of the worst description. One was the site of an old saltpetre factory where even weeds would not grow. I had this soil dug deep (2 feet) and planted thick

(3′ × 3′) with *Inga Saman* (rain trees), *Albizzia procera*, *Albizzia Lebbek*, *Cassia florida*, *Millingtonia hortensis*, *sissú*, *nim*, *&c.* The best were the two first named. They were sown in pans, transplanted when the second leaves developed into single pots, and grown on till about 3 feet high in pots. The salt ground was prepared as above, and the trees planted early in the rains. The ground in three years was completely filled with roots, and to all appearance the salt gone. The trees were thinned out last year only leaving the best, and the ground is very good now.

"'In another place near my house, where the ground was covered with white salts quite one inch thick, and where nothing would grow, I had holes dug 4′ × 4′, and new earth filled in, and large trees 12 months old transplanted with wood poles, I gave the measurements of two on the worst ground to prove how they have grown—*Albizzia* 5 years old, height 40 feet, girth of trunk 4 feet from ground 3 feet 10 inches. A rain tree same age, girth 1 foot 10 inches, height 20 feet, a spreading tree. The ground now is covered with *dúb* grass, and I have some splendid plantains growing there.

"'The trees I think should be thoroughly established in pots before planting, and this should be done in favourable weather just at the commencement of the rains.

"'The *Inga Saman* produces such an enormous quantity of surface feeding roots, and these yearly decay, leaving a rich deposit of vegetable matter in the ground, and making the soil open, and I have no doubt the trees take up the salts too, that in a few years the nature of the soil is completely changed. The trees should be planted as thickly as possible.

"'The timber is first rate for firewood, and the trees bear lopping well. I should think it would be an excellent tree for swampy feverish places in Bengal or elsewhere, being such an enormous water-absorber; it is as valuable as the willow or eucalyptus, the willow being used by the Chinese as a preventative for fever, and always planted round villages in rice districts.

"'*Albizzia* is said to be a valuable timber; it is certainly a very handsome tree. I can give you a supply of seeds, if you care to have them, for distribution and trial in other places.

"'Rain tree seeds can be obtained from Dr. King, Seebpore Botanical Gardens.'"

"Though the question of reclamation of lands impregnated with saline matter is not of such importance in these as in other Provinces, yet it is by no means an unimportant one in Behar, where considerable areas of saline soil are to be found. Dr. King, who was consulted on the subject, sees no reason to doubt the correctness of Mr. Marios' conclusions, and trees have been supplied by

him for experimental cultivation on saline soil to District Officers who have applied for them.

"A sample of the original soil reclaimed by Mr. Maries is at the same time being analysed with a view to determine how far it really contained saline matter."

---

TREATMENT OF PLANTS ATTACKED BY WHITE-ANTS.—A correspondent of a northern paper has very recently made known through its means, the fruits of his experience in connection with a certain very simple mode of so treating plants that are attacked by white-ants as to effectually rid them of those dangerous enemies, and this too, when apparently more powerful methods recommended by scientific authority, had proved unsuccessful, both in his own hands and those of other people. We therefore deem it advisable to make known as widely as we can, the precise nature of his successful operations in order that planters and gardeners everywhere, within the limits of this Presidency, who are suffering by the invasion of those insect pests may have a chance of getting rid of them by following his example. This experimentalist, we must add, before going on to describe his special method, had tried the scientifically prescribed remedy of Phenyle, and had "found that its effects only last so long as the scent of the phenyle remains in the ground. For when this gets faint and dies out, the white-ants will attack the plants so treated." The alternative agency employed by the same party, however,—and which he therefore "would recommend to all amateur and other gardeners,—even the "Superintendent of the Government Botanical Gardens,"—is to adopt the following recipe for keeping white-ants from the roots of young trees and plants:—"Get a common mud pot, and half fill it with coal-tar, filling up the remaining space with water, and then leave it in the sun during the rest of the day. In the evening, look at the solution that has been formed, and, if very strong, put a portion of it into an ordinary watering pot of water, and soak the roots of the young trees or bushes you suspect to be attacked by white-ants with it; also take a small quantity of the strong resolution, and daub the bark of them with a rag or brush well wetted with this for a few inches above the soil. This will prevent the white-ants climbing up, as they are so fond of doing, and barking the trees or shrubs." But the like treatment will not suit vegetables of minor kinds. "I tried it the other day" (adds this expert) "on some cabbages that the white-ants attacked after they had been planted out, but it did not succeed. I strongly suspect

the solution was too strong as the young plants were quite burnt up or scorched." The use of coal-tar, *per se*, to protect fruit-bearing *trees* from the attacks of various insect pests is of course an old story known by all Europeans, although it probably has not reached the ears of natives in general; but applying the same protective to ordinary garden vegetable growths would seem to be a novel practice, which is well worthy of a general trial by all gardeners who find their plants of that description invaded by white-ants, or any other crawling insect pests. Coal-tar water will most likely repel any of these which come within scent of it, to say nothing about the effect on them of its *taste*; for everyone who is acquainted with that product of the gas-works must well remember how highly offensive is its *smell*, and how difficult is the operation of cleansing any part of one's person or clothing which has had the ill-luck to get smeared with it accidentally. Before quitting this subject, we may as well draw attention to a kindred matter of considerable importance to coffee-planters at large, since it concerns the doubtful value, to their estates of a certain tree, on which they have hitherto placed much reliance, to wit, the "Atti" (*Ficus racemosa*) regarding which a correspondent has written thus to a Bengal journal:—"It is an open question whether the "Atties" do good by attracting the green bug to themselves, away from the coffee, or harm, by attracting this pest to the estate. I most reluctantly admit my own opinion is, that they must, and cannot but, do harm. For they form great breeding places all over the estate; and although for the time being the bug may keep to them in preference, I fear that it would cease to do so with the disappearance of green leaves and shoots. It is a terrible dilemma that we are in: extermination—if it be possible—cannot be carried out unless every "Atti" tree on the estate, so soon as attacked, is cut down and burnt. And this is the tree that we have so carefully reared and brought up for shade."—*Indian Agriculturist.*

## THE NILGIRI 'STROBILANTHES.'

THIS large genus of very interesting forest shrubs contains, according to the Flora of British India, 146 fully described Indian species. There is scarcely any part of India in which at least one species may not be found, while in some parts the species are so common as to be specially remarkable. Everyone who has been in Simla and taken an interest in its Flora, must have seen the beautiful blue flowers of *S. alatus*, in the woods of Mahasu, Theog and Nagkanda. Visitors to Darjeeling can hardly have helped noticing, in those years in which they have flowered, the graceful purple corollas of *S. divaricatus*, brightening the banks of the Birch Hill walks, the tangled growth of the bright-blue flowered *S. Wallichii* at Senchal, and the variegated leaves of *S. petiolaris*, on the road to Rungbee. In Assam, the handsome *S. flaccidifolius* is cultivated for the sake of the indigo dye which its leaves afford, while another Assam species, *S. isophyllus*, is a common ornament of the gardens of Calcutta. *S. auriculatus* is a cold-weather flowering species, which may be seen in perfection in the sál forests of Chota Nagpore, and away down into those of Ganjam; while the species which Mr. C. B. Clarke considers the finest of all, *S. scrobiculatus*, adorns the ghâts of the Bombay Presidency, and should be well known to the botanists of Mahabaleshwar. But it is probably in the South of India that the Strobilanthes reach their largest size, and are most conspicuous; and though there are some very fine ones to be found in the Anamalai, Pulney and Travancore hills, it is especially in the Nilgiris that the shrubs are most easily seen in perfection.

The annexed list shows most of the species of the Nilgiris. Most of them the writer has collected himself, but one or two he has received from Mr. M. A. Lawson, the Government Botanist of

x

the Madras Presidency. The Flora of British India which describes the specimens in the Kew Herbarium collected by Wight, Gardner, Beddome and others, might add two or three species, and there are probably several whose flowers are not yet known. The writer knows two or three species by the leaf only, but has not yet succeeded in finding the flowers.

The 'Strobilanthes' do not all flower regularly every year: some few species do, like *Wightianus* and *Perrottetianus*, but more ordinarily the species flower only after long intervals and then die down. The stems if not burnt, rot away, and the next year the ground underneath is carpeted with a mass of young seedlings which gradually grow till their time of flowering comes again, and then die off in their turn. *S. homotropus* died off in this way on the Sispara ghât in 1884, *S. asper* at Naduvatam, and *S. sexennis* on Doddabetta in 1885, and *S. pulneyensis* on Cairn Hill in 1886. *S. heteromallus* also flowered in 1886 on the Coonoor ghât, and has probably since died. So dense is the thicket of Strobilanthes in the undergrowth of the forests, that under ordinary natural circumstances it is really only at the time of the periodical flowerings that the tree seedlings get a chance of a start. There are usually thousands to be found under the thicket, but until the Strobilanthes dies, or is cut away, they simply remain stunted, waiting till the removal of the cover gives them a chance, and then they usually take advantage of it and come on quickly. It has, consequently, on the Nilgiris been lately found useful to assist in disengaging the seedlings by clearing away the growth of Strobilanthes. In the forests around Ootacamund and Coonoor, where there is a large demand by the poorer classes of natives for small fuel, and where the hard, brightly burning wood of the Strobilanthes is much appreciated, it is possible to clear away the growth of it and not only allow of the young tree seedlings getting a chance of growing, but provide a considerable amount of fuel, ample, at very cheap rates, to cover the whole cost of the work. In the Lamb's Rock forest, 37 acres 'cleaned' in 1886, at a cost of Rs. 222, produced 9,038 head-loads of fuel (about 323 tons), realizing, at one anna each, Rs. 565, equivalent to a net profit of Rs. 9-4-0 per acre. Something like nine-tenths of the material cut consisted of 'Strobilanthes.' The good results of this work were most marked: myriads of seedlings were disengaged, and a few years hence, with the help of a seed cutting or cutting under selection in the cover, what was a few years ago merely a dilapidated shola with cover of old, mostly unsound, trees and underwood of Strobilanthes, will be converted into a fully

stocked pole forest. It may easily be understood that the clearing of Strobilanthes must precede the seed cutting, or the cutting under selection (jardinage). When the cover over-head in a forest is light, the bank of Strobilanthes underneath is often very valuable as assisting to retain the moisture in the soil, prevent fires, and nurse the tree seedlings, and in some cases it is best not to clear away the growth too wholesale, but to disengage seedlings in plots where they are found sufficiently thick and good. An example of a shola in which not only the Strobilanthes were cut, but also the covering trees some years ago, may be seen in the valley at the back of the inspection house at Naduvatam. There, the growth of new Strobilanthes and tree seedlings together is so thick as to be at the disadvantage of the latter; and, did funds admit, the Strobilanthes should now be thinned out.

The most common and best known species is *S. Kunthianus*, which prefers the dry slopes of the eastern side of the hills, where there is little or no tree-forest. In such localities it is chiefly found associated with the Nilgiri gooseberry (*Rhodomyrtus tomentosa*), the bright flowered *Hypericum mysorense*, the yellow raspberry (*Rubus ellipticus*), the barberry (*Berberis aristata*), the shining leaved *Dodonæa viscosa*, the pink-flowered *Sophora glauca*, and the wild date *Phœnix pedunculata*, while the beautiful large white bells of the Nilgiri lily (*Lilium neilgherrense*) may be seen in places lifting their heads through the shrubby growth. But when in flower it is the Strobilanthes which gives its colour to the scenery, and the hills may often be seen coloured of the bright blue colour which has led some persons to attribute to this circumstance the origin of the name of the 'Blue mountains.' *S. Kunthianus* flowers at intervals of some four to six years. It flowered profusely in 1881 and again in 1886, and may be again expected to flower about 1891, though sporadic flowering specimens which have not died may here and there be met with in most years. On the downs to the west of Ootacamund the *S. Kunthianus* is replaced by the much smaller *S. sessilis*, a beautiful plant of a lovely tinge of blue. Almost every year the sholas of Ootacamund become gay in autumn with the blue, lilac or white flowers and the reddish young leaves and bracts of *S. Perrottetianus*, while in some sholas *S. foliosus*, a quite different looking kind, is more common, and grows to a larger size of wood, having often stems of 4 to 6 inches in diameter. The chief species on the higher parts of Doddabetta is *S. sexennis*, which has a powerful and rather unpleasant odour, though when in flower, it shows a beautiful mass of bright blue panicles. It flowered last in 1883, and then died down, leav-

ing its knotty stems to be used as fuel and myriads of seedlings to form a new crop.

In 1886 there flowered in the Cairn hill sholas a species with a curious narrow-necked bell-shaped flower, which has been identified as *S. pulneyensis*, hitherto only known from the Pulney hills. Another common Ootacamund species is the rough looking *S. Wightianus*, which grows indiscriminately on grass land or in shola, and flowers yearly.

About Coonoor, in the Lamb's Rock and Tiger Hill forests, besides *S. foliosus* and *S. Perrottetianus*, a species is found which Col. Beddome says he watched for years without finding flowers. The flowers came in 1886, and the plant seems now to be identifiable with *S. heteromallus*, except that the seeds, instead of being glabrous as described by Mr. Clarke, and as shown in the very few specimens in the Kew Herbarium, show when wetted, a dense mass of shaggy white hairs. This species grows to a very large size on the Coonoor ghât, and does not seem to have been gathered in flower since Dr. Wight collected it in 1850. As Col. Beddome had, during these 36 years, such fine opportunities of watching it, it may be that its period of growth is so long as 36 years, or it may have flowered unnoticed every 12 or every 18.

Some of the most beautiful species are those of the Kundahs, and especially at Sispara, where in 1883 was found the beautiful but sticky *S. amabilis*, with its large panicles of pink bells, and the woolly-leaved *S. gossypinus*, which almost alone gregariously covers one large hill side above Sispara. Col. Beddome collected this species in 1870 and the writer in 1883, so that its term may be 13 years, though a specimen of its wood in the Madras collection shows only ten annual rings. The wood is a very hard one, of a pretty brown colour; indeed, the wood of most species, though usually white or grey, is hard and strong, and makes an excellent small fuel. About Naduvatam *S. asper*, a rough looking shrub, flowered gregariously in 1885, and died off, and in 1888 the same happened at Sispara, as already mentioned with *S. homotropus*, a species closely allied to *S. sexennis*. In the same year was found the species which is probably the most beautiful of all, *S. violaceus*, only found in a shola near Bangi Tappal, where it overshadows a fine growth of that splendid fern *Lomaria Patersoni*. The flowers are a deep violet, and so far as is known, it was last gathered by Col. Beddome in 1870.

This short account of the Nilgiri Strobilanthes ought not to close without mention of *S. luridus*, a straggling species of the western forests of Sispara to Naduvatam. It has cone-like spikes

of large dark purple flowers, of which a white variety occasionally occurs, and which grow on the stems on the old wood. It has a near ally in a remarkable species which is only found in the valley at the head of the Noyil river in Coimbatore, *S. bolamputtensis*, a curious species with large serrated orbicular bracts and brown flowers.

The whole genus is one of great interest to the Indian Forester, and to the lover of beautiful flowers. Seeds are often sent home, and the growers wonder why they do not flower; perhaps these remarks may help them to understand the reason.

---

*List of Nilgiri species.*

Section I. 2 stamens. ENDOPOGON.

1. *S. foliosus*, T. And. Very common above 6,000 feet in all the sholas about Ootacamund. Flowers blue, appear annually, leaves bright green.

2. *S. Kunthianus*, T. And. Common and gregarious on dry slopes everywhere above 4,500 feet. Flowers light blue, appearing about every six years; leaves grey beneath, thick.

3. *S. gossypinus*, T. And. Only about Sispara, on the hills between it and the Nadghani precipices at 5 to 6,000 feet. Flowers lilac, appearing about every 10 years; leaves covered with dense yellow wool.

4. *S. cuspidatus*, T. And. Common on the Sigúr ghât at 4 to 6,000 feet and occasionally elsewhere. Flowers blue, probably annual, leaves white silky beneath.

5. *S. consanguineus*, Clarke. Scarce. Northern valleys—Masnigudi—flowers blue.

Section II. 4 stamens. EUSTROBILANTHES.

A. *Bracteate*—

6. *S. barbatus*, Nees. Ochterlony valley and south-east Wynaad, at about 3,000 feet; collected lately by Mr. M. A. Lawson.

7. *S. heteromallus*, T. And. Very common and gregarious on the upper parts of the Coonoor ghât about Benhope—altitude 3 to 4,000 feet. Flowers lilac, appearing about every 10 to 12 years; leaves rough.

8. *S. Wightianus*, Nees. Very common all round Ootacamund, but small. Flowers pale blue to dull lilac, annual; leaves rough.

9. *S. pulneyensis*, Clarke. Sholas on Cairn hill, Ootacamund, 7,000 feet. Flowers blue, appearing about every 8 years.

10. *S. neilgherrensis*, Bedd. Wet forests in south-east Wynaad Flowers blue.

11. *S. Perrottetianus*, Nees. Sholas of the upper plateau, very common at Ootacamund. Flowers light blue, lilac or pink, appearing annually ; leaves soft, hairy.

12. *S. Zenkerianus*, T. And. Sholas of Doddabetta and Avalanché at 7 to 8,000 feet ; rather like *S. foliosus*. Flowers blue ; leaves smooth green.

13. *S. ciliatus*, Nees. Western slopes, Carcoor ghât, about 2 to 3,000 feet (M. A. Lawson). Leaves smooth.

14. *S. tristis*, T. And. Western slopes, Ochterlony valley (M. A. Lawson). Has deflexed pedicels and smooth leaves.

15. *S. Heyneanus*, Nees. A small species of the Wynaad in forest underwood. Flowers blue, in hop-like clusters, leaves rough.

16. *S. micranthus*, Wight. A large species, common in Longwood shola at Kotagiri, where it flowered in 1885. It probably flowers about every 8 to 10 years.

17. *S. papillosus*, T. And. Shrub common in the Kundahs and in a few ravines on Doddabetta at 8,000 feet. Flowers blue, apparently annual ; leaves rough, also the bracts.

18. *S. luridus*, Wight. Straggling shrub with large hop-like clusters of flowers on the stem, sholas of western slopes—Sispara to Naduvatam at 4 to 5,000 feet. Flowers dark purple, sometimes white, appearing annually ; leaves large.

19. *S. asper*, Wight. Common about Naduvatam at 4 to 5,000 feet ; rare elsewhere. Flowers small, blue.

20. *S. sessilis*, Nees. Small species in tufts on the downs. Flowers blue, appearing probably every 4 to 5 years.

B. *Paniculate*—

21. *S. sexennis*, Nees. Large shrub, common on Doddabetta at 8,000 to 8,500 feet. Flowers blue, appearing about every 6 to 7 years, leaves bright green, narrow.

22. *S. homotropus*, Nees. Large shrub very like *S. sexennis*—common in the Kundahs. Flowers blue or white, appearing about every 10 years, leaves bright green.

23. *S. violaceus*, Bedd. A rare shrub. Kundahs near Bangi Tappal. Flowers panicled, violet, appear about every 7 years.

24. *S. amabilis*, Clarke. Shrub, western slopes. Sispara 5 to 6,000 feet. Flowers panicled, pink, appearing about every 10 years, very sticky.

KEW,<br>*4th November, 1887.*

J. S. GAMBLE.

# THE MINERAL CONCRETION OF THE TEAK TREE.*

AT the last meeting of the Nilgiri Natural History Society Mr. Lawson showed a specimen of a whitish mineral substance found in a teak tree growing in the Government Plantation at Nilambúr. This peculiar secretion is not altogether unknown to officers in the Forest Department, and its composition has on more than one occasion been investigated by chemists.

In 1870 the fact of calcareous masses occurring in timber was brought to the notice of the Asiatic Society of Bengal by Mr. R. V. Stoney, who stated (*vide* P. A. S. B., May 1870, p. 135) that many trees in Orissa had pieces of limestone or calcareous tufa in their fissures, but principally asan (*Terminalia tomentosa*, W. and A.), swarm (*Zizyphus rugosa*, Lam.), sissu (*Dalbergia sissu*, Roxb.) and abnus (*Diospyros melanoxylon*, Roxb.)

In 1880 Mr. V. Ball in making a geological survey in the Central Provinces met with this concretion, and thus alludes to it in his "Jungle Life in India." "Some white marks on the cut stumps of an asan tree caught my eye, and these on examination proved to be sections or laminæ of calcareous matter which alternated with the ordinary rings of woody growth. The rocks about were gneisses and schists, and I could discover nothing in the soil to account for the peculiarity. In some cases irregularly shaped pieces 7 inches long by 2 inches thick were met in the trunks at a height of about 6 feet from the ground. By the natives the lime is burnt and used for chewing with *pan*. On examination it was found there was no structure in these masses which would justify a conclusion that they had been formed by insects. Some included portions of decayed wood seemed to be cemented together by the lime."

Major General Morgan, late Deputy Conservator of Forests, Madras, speaks of it in the following terms in his "Forestry of Southern India"—"It is a curious fact that in the Wynaad, though there is no free lime in the soil, yet teak (*Tectona grandis*) and blackwood (*Dalbergia latifolia*), if wounded near the ground contrive to absorb large quantities of lime. It may be seen encrusting the tree on the surface as far as 4 feet in height, from 3 inches to a foot in width, and 2 or 3 inches in thickness. The lime is so hard that it destroys circular saws, and the Carumburs use it for chewing with betel.

* A paper read at a meeting of the Nilgiri Natural History Society, Ootacamund, November 7th, 1887.

Abel in 1854 thus described it—"The wood of teak, which grows in the South of India and other tropical countries, frequently exhibits cracks and cavities of considerable extent lined with a white crystalline deposit consisting chiefly of hydrocalcic orthophosphate, $C_a H PO_4, H_2O$, with about 11·4 per cent. ammonio-magnesium phosphate." (Chem. Soc. Qu. J. xv. 91).

This white deposit in the wood of teak has also been examined by Thoms, who found it to consist of monocalcic orthophosphate $Ca H PO_4$. (Landw. Versuchs. St. xxii. 68; xxiii. 413). More recently still Professor Judd has found in teak a specimen of crystalline apatite, a well known mineral containing a large proportion of calcium phosphate.

"The formation of this deposit indicates that the wood itself must contain a considerable quantity of phosphoric acid, and the analysis shows this is really the case as the ash of teak wood is composed as follows :—

| $C_aO$ | $M_gO$ | $F_eO$ | $K_2O$ | $N_a{}_2O$ | $SiO_2$ | $SO_3$ | $P_2O_5$ | $CO_2$ | Cl |
|---|---|---|---|---|---|---|---|---|---|
| 31·35 | 9·74 | 0·80 | 1·47 | 0·04 | 24·98 | 2·22 | 29·69 | 0·01 | 0·01 |

The percentage of carbon and hydrogen are higher than in most woods, and this together with the richness in calcium phosphate and silica may perhaps account for the great hardness of teak." Watts' Dict. Chemistry, 3rd Sup., p. 1894.

The sample from Nilambúr was in the form of a rounded flattened cake about 10 inches in diameter and 2 or 3 inches in thickness; dirty white in color, with a rough gritty surface. A sample was made for analysis by breaking off portions from different parts of the cake and reducing the whole to a fine powder. The powder examined under the microscope was mainly in an amorphous condition similar to prepared chalk, with a dark colored gummy matter, and a small quantity of crystalline quartz sand. The following is the composition :—

| | |
|---|---|
| Calcium carbonate, ... ... ... | 70·05 |
| Tricalcic orthophosphate, ... ... ... | 2·89 |
| Quartz sand, ... ... ... ... | 9·76 |
| Organic matter, ... ... ... ... | 14·30 |
| Moisture, ... ... ... ... | 3·00 |
| Total, ... | 100·00 |

The analysis shows that the principal compound is calcium carbonate, and the concretion approaches nearer the chalk or limestone formation than that of the apatite or phosphatic found by other investigators. An examination of deposits from other trees

ght show greater differences than these, but it seems enough has been done to prove that the calcium element forms the base.

The sand, probably blown up as dust and made to adhere by the organic matter, is a mechanical ingredient. The deposit contained no salts of sodium or calcium soluble in water, nor any ammoniacal compounds; this would stand to reason, as the heavy rains to which this district is subjected would scarcely leave anything soluble on the trees.

A sample of the soil from the Teak Plantations, the same as that in which the Ipecacuanha is being cultivated, has also been examined. It is a light reddish brown sandy loam with quartz. In a dry state it contains 79 per cent. of silica and silicates, about 5 per cent. of organic matter, the same of iron oxide and alumina, and ·217 per cent. lime a as oxide.

The scanty amount of lime present in the soil, and the large amount found in the tree, show what an enormous quantity must have been taken up by the sap. I have shown elsewhere that a full sized cinchona tree contains about 10 ounces of lime (as slaked lime), not concentrated by abnormal development in one place, but distributed in all its parts. A teak tree from its size and ash contents would have a much larger supply than a cinchona, and yet, it seems, is able to excrete it in some abundance. In what manner this takes place is not easy to determine. The calcium enters the plant in a soluble form as sulphate. The calcium unites with oxalic and other acids and is precipitated, while the sulphuric acid parts with its sulphur to form organic compounds. A wound in the tree is liable to render these processes abnormal by causing the vegetable acids to ferment by exposure to the air and to yield carbonic acid as one of the products, and this meeting with the calcium in the ascending sap exuding from the wound might convert it into an insoluble calcium carbonate which would harden in the cavity of the tree and form the deposit.

D. HOOPER.

## TIMBER *VERSUS* METAL SLEEPERS.

THE following notes from recent numbers of "Indian Engineering," represent the opinions of competent authorities regarding the relative value of deodar *versus* metal sleepers.

A first-class deodar sleeper 10′ × 10″ × 5″ costs on an average at Lahore Rs. 3-2, and this sleeper when *fully* equipped with chair, spikes, &c., costs Rs. 4-6-6 when laid on the roadway. On the other hand, the price of a fully equipped oval bowl metal sleeper is Rs.

Y

7-11-6, or Rs. 3-5-0 in excess of the cost of a deodar broad gauge sleeper. It should also be noted that metal sleepers are much more liable to damage during transport than wooden ones.

It is further shown that the cost of ballasting a line laid with wooden sleepers is more expensive than that of a line laid with metal ones, so that finally the saving is reduced to Rs. 2-1-2 in favour of the wooden sleepers.

"The age to which a wooden sleeper will do its work, is, in common with the metal sleeper, dependent to a great degree on the description of maintenance it receives. Taking a first-class deodar sleeper, the road it is laid in, well maintained, the traffic—the average traffic of a Northern India line—I fix the age to which it will attain before demanding removal at 20 years.

"The age of the metal sleeper under exactly similar conditions may, I think, be taken at 40 years.

"In many parts of Northern India traversed by railway, where the quantity of salt in the earth is very excessive, this 40 years of life I have given is liberal to a degree. Salt is disastrous to the metal sleeper, so much so, that in these salt plains I am confident a wooden sleeper would outlive a metal one. I will, however, to strengthen my case, take no advantage of this fact, but will allow the age of the metal sleeper to be 40 years."

In comparing the relative cost of maintaining the two different classes of roadway, it appears that there is a saving of Rs. 53-8, per mile, per annum, in favour of the timber sleeper line of railway.

It is also generally admitted that the tear and wear of rolling stock and the damage done to the rails is much less on a timber road than on a metal one, which fact represents a further saving of no small importance in favour of wooden sleepers.

Again it is explained that in the case of minor accidents, which are the most common on Indian lines, it is found that the damage done to the permanent way and rolling stock is always much greater in the case of lines laid with metal sleepers.

In such accidents the metal sleepers are generally smashed to atoms, whereas on lines laid with wooden sleepers those suffer little, and the damage done to rolling stock is usually trifling. The writer then goes on to show that at the end of 20 years the total saving, effected on a line laid with wooden sleepers will be Rs. 10,026 per mile on account of original cost and maintenance, and that after having relaid the line at a cost of Rs. 6,400 per mile, which will carry it on for another period of 20 years, or to the whole life of the metal sleeper roadway, there will net saving of Rs. 3,626 in favour of the timber road.

"What amounts could be added to this, on account of the longer life bestowed on rolling stock and rails, and what on account of savings in accidents (all due to the timber road) it is impossible to say, but I do not think I am giving too much in favor of the timber sleeper, if I say that the cost of minor accidents (and these, be it remembered, are the ruling accidents in India, and are besides very numerous), is ten times as much on 'metal roads' as on timber ones.

"There is another point in favor of the wooden sleeper, to which I have not yet alluded; this is, rate of exchange between India and Europe. My pricing of metal sleepers is based on figures which existed 6 months ago, but are now larger by reason of a falling exchange, and with a prospect of a further fall the advantages of using timber sleepers locally produced is still more apparent."

Several interesting remarks are made by one of the writers regarding the relative qualities of timber for sleepers, which may be summarized generally as follows :—

"The best building timber in the Punjab is *deodar*, which is obtained in large lengths in the hills. It possesses *strength, hardness, stiffness,* and *durability*, and is, therefore, well fitted for sleepers on the railway, entailing less wear and tear to rolling-stock, less breakage of sleepers in case of accidents, and also being much cheaper than other kinds of sleepers.

"For broad as well as narrow gauge, it is equally good, and is easily obtained in large quantities, at convenient places. Best heart-wood should only be used, and all defective wood rejected, it should be entirely free from sap-wood, large, and loose knots, flaws, shakes, and splits, and should be well seasoned. *Picked heart-wood* is free from the attacks of white-ants, and the ravage of other insects."

In conclusion, one of the articles contains the following important observation with regard to the desirability of Government retaining its money in the country instead of remitting it to Europe on account of the purchase of metal sleepers, in which case the Indian Government sustains a still further loss on account of exchange :—

"That it is to the interests of the Government to keep its money in this country cannot be contradicted. The people of this country, both Europeans and natives, are entitled to benefit directly, as well as indirectly, by the making of railways. The Indian Government has laid down an order, that when articles of local (*i.e.*, country) produce compare favorably, in description and cost with articles of European manufacture, they are to receive preference by officers purchasing on behalf of Government. In the matter of sleepers the Government should go further and give the Indian deodar sleeper the preference of the metal one, even if it were proved to be more expensive. The liberal use of timber sleepers being assured, capitalists would invest capital in growing timber and producing sleepers. Large areas of land in the hills, now barren, would be planted,

and the country opened up, and employment would be found for a large number of Europeans and natives who can now find none.

"Proved, however, as it easily can be, that the timber sleeper is cheaper than the metal one, both in initial cost, and throughout its life, it is imperative on the Indian Government to encourage its production in every possible way, and to secure for its own use every decent sleeper offered."

---

## COMPARATIVE TEMPERATURES ON HILL STATIONS AND IN THE PLAINS IN THE NORTH-WEST PROVINCES, INDIA.

A GLANCE at the daily weather reports issued by the Meteorological Reporter to the Government of India, will show that during certain times of the year the minimum or early morning air temperatures at the hill stations 5 or 6,000 feet above the plains are very little lower than at the plain's stations. Indeed, there are days when the temperature on the hills in the early morning is actually higher than in the plains. That this should be the case is explained by the action of radiation which causes cold air to accumulate in the plains whilst the overlying air is comparatively warmer. This has been demonstrated in a remarkable manner in Dehra Dún by means of the scaffolding previously described in the "Indian Forester." The air 66 feet above the ground was found to be as much as 12 degrees warmer during the early morning than the air 4 feet above the ground. This effect of nocturnal radiation shows itself also when the plains and mountain tops or ridges are compared with each other. To make this very evident, temperatures were observed at the exceptional height of 9,000 feet above the sea, at Deoban forest chauki in the Jaunsár Division, North-Western Provinces Forest Department. Simultaneously the temperatures were also observed at Dehra Dún in the forest office and 7 miles out (south-east) near a forest camp, called Rámgarh, in midst of a sál forest. Both latter places are about 2,000 feet above the sea, and therefore 7,000 feet below Deoban.

Unfortunately the temperatures at Deoban were observed half an hour later every day than at Dehra Dún and Rámgarh, but allowance can be made for this. The annexed table shows that there is as much difference between the Dehra Dún office station and the forest station of nearly the same height above sea level as there is between the latter and Deoban.

The Deoban station is only 3 degrees below the Rámgarh forest station. If we allow 2 degrees on account of the difference of time, we will have Deoban 5 degrees lower than Rámgarh, and 8

degrees lower than Dehra Dún forest office in the mean. On the 27th of December, Deoban showed actually a higher temperature than the two lower stations; on the 29th, Deoban exceeded Rámgarh; on the 7th of January Deoban equalled the mean of the two lower stations.

It is intended to establish regular meteorological observations at Deoban in the course of this year, when more reliable comparisons will be possible.

| Date. | Dehra Dún Forest Office, above 2,000 feet. | Rámgarh Forest *Camp near Debra* Dún, about 2,000 feet. | Deoban Forest Chaukí about 9,000 feet. |
|---|---|---|---|
| | 7-30 A.M. | 7-30 A.M. | 8 A.M. |
| 15th Dec., 1887, | 42 | 40 | 34 |
| 16th ,, ,, | 39 | 38 | 34 |
| 17th ,, ,, | 40 | 38 | 33 |
| 19th ,, ,, | 38 | 36 | 35 |
| 20th ,, ,, | 44 | 41 | 35 |
| 21st ,, ,, | 40 | 38 | 35 |
| 22nd ,, ,, | 44 | 39 | 36 |
| 23rd ,, ,, | 44 | 42 | 37 |
| 24th ,, ,, | 42 | 40 | 35 |
| 27th ,, ,, | 35 | 34 | 38 |
| 28th ,, ,, | 39 | 33 | 34 |
| 29th ,, ,, | 35 | 33 | 35 |
| 30th ,, ,, | 37 | 34 | 35 |
| 31st ,, ,, | 35 | 35 | 31 |
| 2nd Jan., 1888, | 38 | 34 | 32 |
| 3rd ,, ,, | 36 | 36 | 32 |
| 4th ,, ,, | 36 | 36 | 32 |
| 5th ,, ,, | 38 | 35 | 33 |
| 6th ,, ,, | 38 | 36 | 33 |
| 7th ,, ,, | 36 | 34 | 35 |
| 9th ,, ,, | 37 | 34 | 33 |
| 10th ,, ,, | 38 | 37 | 35 |
| 11th ,, ,, | 39 | 38 | 35 |
| 12th ,, ,, | 43 | 36 | 36 |
| 13th ,, ,, | 41 | 38 | 34 |
| 14th ,, ,, | 40 | 38 | 33 |
| 16th ,, ,, | 51 | 43 | 39 |
| 17th ,, ,, | 38 | 38 | 33 |
| 18th ,, ,, | 37 | 34 | 26 |
| 19th ,, ,, | 35 | 34 | 27 |
| 20th ,, ,, | 35 | 35 | 26 |
| 21st ,, ,, | 44 | 36 | 28 |
| 32 days Mean. | 39·2° | 36·7° | 33·4° |

## COMPOUNDING FOREST OFFENCES.

In a note on page 73 of the "Indian Forester," the Editor explains that the plan of compounding forest offences works admirably in the N.-W. Provinces. The Divisional Forest officers personally examine the offenders, and do not send petty cases to a Magistrate. When any important case is sent up to a court, the opinion of the Government vakil is generally first obtained on the subject. I think some further information concerning the procedure of sending for the witnesses, &c., will be instructive. What is done in case a witness, or an offender, does not wish to appear before the Divisional Forest officer? Is the Protective Forest staff of the N.-W. Provinces sufficiently strong to arrest and convey forest offenders to some long distance, where the Divisional Forest officer resides or encamps? If the arrest is made at evening, is the offender kept in custody, if so, how is that done?

Do the witnesses consent to come up to the Divisional Forest officer on their own accord?

If an offender refuses to give compensation, is he detained in custody until the opinion of the Government vakil has been obtained?

Does the Police, if called upon to interfere, bring up the offender before the Divisional Forest officer before taking him to the court. In short, the personal enquiry of Divisional Forest officer into all the forest cases seems to be somewhat impractical in Divisions with detached forests, specially when Divisional officers have to attend to their multifarious duties of out-door and office work.

*3rd March*, 1888. S. S.

The Forest Divisions in the N.-W. Provinces are fairly compact, the distance to be traversed by the Divisional officer rarely exceeding 20 miles from a central point.

In serious cases, offenders are at once arrested by the Forest Guards and brought before the Divisional officer; in other cases, the Range officer merely reports to the Divisional officer, and the latter then fixes a place and date suitable to all parties for enquiring into the case. As Divisional Forest officers are always moving from point to point of their Divisions, except during the four monsoon months, when offences are rarely reported, there is practically no difficulty in this procedure.

In more serious cases, offenders may be kept in custody until they can be brought before the Divisional officer, or until the Range officer has sufficiently investigated the case to report it. Each Forest Guard has his chauki, and chaukis in the School Circle are now being built in a permanent manner, and the offenders can readily be kept there for one night if necessary.

As a rule, offenders are either shikaris, purchasers of forest produce who have grass huts in, or close to, the forest, or villagers who live in its proximity, and occasionally petty dealers from a town. Such men can be released and brought up for enquiry, whenever required.

There is seldom any difficulty regarding the attendance of witnesses to forest offences, and they are generally Forest Guards or purchasers of forest produce.

In the case of offenders refusing to pay compensation when the Divisional officer may consider their offence proved, and has proposed it, the case, if a serious one, is shown in writing to the Government vakil, and if he considers the case a good one, report is made to the Magistrate, who fixes a date for hearing the case. Pending the report of the Government vakil, the defendant is released and returns to his home.

In certain cases, where the evidence appears to be sufficiently clear, the case is at once sent to the Magistrate, the Forest Guard or Range officer conducting it personally.

It is very seldom that the assistance of the Police is required, the Forest staff being quite strong enough to arrest offenders, and the people being generally ready to submit to their authority. Our forest chaukis are much more numerous than Police thánahs, and application to the Police in purely forest offences hardly ever occurs, though in offences under the Penal Code, it may be necessary. Forest officers in the N.-W. Provinces spend 8 months every year in camp, and being constantly in their forests, have no difficulty in attending to their duties, however multifarious they may be, and always consider enquiries into forest offences as above all their other duties.—[ED.]

---

## NOTES ON INSECT RAVAGES IN PINE FORESTS.

THE study and prevention of disease in forest trees is of such great importance, and so intimately connected with the prosperity of forests, that a few notes on a disease in the form of a pest of insects, which has done extensive injury in many of the pine forests under my charge (the Sutlej valley, Bashahr), may be of interest.

The pest to which my notes refer, made its appearance during the summer of 1882, and spread at an alarming rate over large areas. Young, vigorous trees invariably shook it off, but less hardy ones were either rapidly killed, or after lingering for some time, died out. The leaves of infected pines turned an unhealthy yellowish color, and the branches dried and curled up into claws, giving a most wretched appearance. At the end of the rains, the disease abated, and to all seeming disappeared, and for four years the forests were free from its ravages. But in June 1887, it returned, and this time attacked both the *Pinus excelsa* and *Pinus Gerardiana*. In July, I noticed that the leaves of the affected trees were beginning to change color, and that the insect had preferred, for first operations, the ends of branches, and that it had tunnelled out, between the bark and the sapwood, longitudinal galleries, which, on close inspection, I found to contain larvæ and weevils.

I continued to observe these during the rains, and I suspect, that the hollowed out interiors of the tender shoots are designed for the reception of eggs, and the rearing of larvæ, as later on, when no more larvæ remained, the perfect insect abandoned the tender shoots for larger branches, through which it worked holes as far as the heartwood, and in the direction of the axis of the stem. Branches thus attacked were tattooed all over and did not survive long. No eggs or larvæ were, however, observed in them, and I think they are merely scooped out to obtain food. This destructive insect belongs to the order Coleoptera, and is probably some species of Bostrichus. It is one-tenth of an inch long, with dull brown colored elytra, and its larva is a small white grub of the same length, but as I am sending you specimens of larvæ and perfect insects for identification, I will not attempt to describe it further. Its duration of activity is three months, which is as long as the rains last, for at the end of September, its depredations ceased, and in October, I had difficulty in finding any beetles alive. But doubtless, they leave behind in dead wood ample deposits of eggs which are hatched on some favorable atmospheric change occurring.

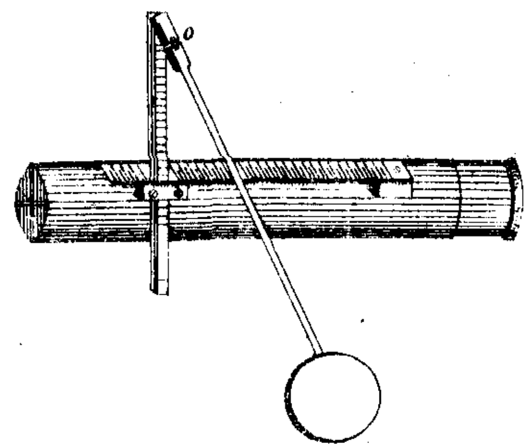
At Changa Mangá in 1875-76, after large thinning operations, the ground was littered with refuse wood, and a similar pest occurred. I was, therefore, in the present instance inclined to attribute the origin of this beetle to forest litter, which in the forests of this Division is composed chiefly of branches of the deodar trees felled annually, and of the loppings left by the people in forests open to rights. In spite of periodical efforts to collect and burn such refuse, there always remain, particularly in the unclassed forests, large quantities of decaying litter, which is well known to harbour insects. I failed, however, to discover in collections of forest refuse any trace of the weevil described above, and I must suppose that the outbreak is due to some other cause. The only remedy which suggested itself at the time was to lop off all tainted branches on the first sign of the disease, and remove the trees that had gone too far. Besides, insectivorous birds have always been protected. But there may be other well known means of preventing and stopping the development of diseases in trees, caused by insects: and I hope some of your correspondents will be good enough to throw some light on the subject.

G. G. M.

Specimens of the larvæ of the insects attacking the pine trees and of their ravages have been received, and will be sent to the Indian Museum, Calcutta, with a printed copy of the above paper.—[ED.]

## WEISSE'S HEIGHT MEASURER.

WEISSE'S instrument for measuring heights consists of a tube which pulls out and is provided with cross wires, and with a scale of heights which rests on it lengthways, and a scale of distances which is fixed upright. A pendulum is also attached to the scale of distances at the upper end O. When not in use, the tube serves as a receptacle for the scale of distances and the pendulum.

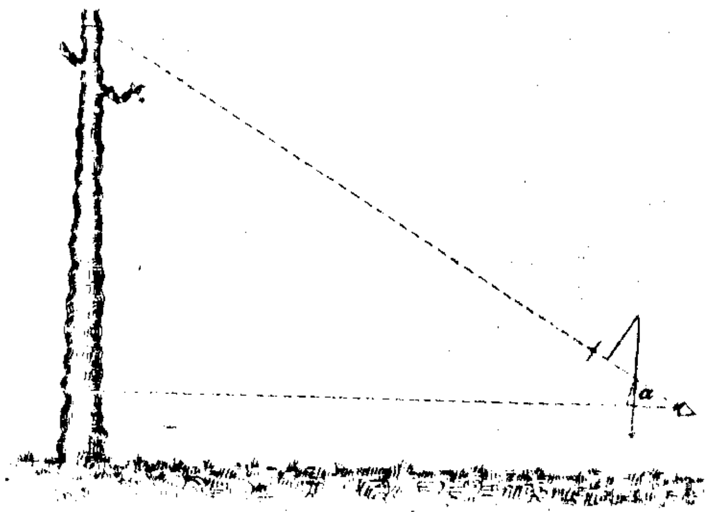



If it is desired to determine the height of a tree, we select a point from which the foot and the top of the tree can be seen. The line from the tree to this point is used as base line and is measured. Its length should be as nearly as this can be estimated equal to the height of the tree. The true length of the base line is measured.

The scale of distances which is fixed upright to the tube is then so moved that the projecting upper portion of the scale indicates the length of the base line. (The scale is in metres, but for use in India it could easily be changed into feet). This done, the tube is held in the right hand, brought to the eye and directed to the top of the tree.

The tube is so turned that the cross wire appears vertical, and the top of the tree is made to cover the centre of the cross wire. Maintaining this direction of the tube, the latter is then slowly turned round its axis from right to left and back again. This is repeated two or three times, and then the instrument is taken from the eye. The scale of heights is provided with teeth, which stop the pendulum. The number of the scale at which the pendulum is stopped represents the height of the top of the tree above the eye.

To find the full and true height of the tree it is necessary also to direct the tube to the foot of the tree. If the pendulum is stopped this side of zero, the number indicated on the scale is to be deducted from the former height. If the pendulum is stopped on the other side of zero, the number on the scale is to be added to the former height.




The whole theory of this instrument is based upon the similarity of rectangular triangles, as shown by the diagram. When (*a*) and (*b*) have equal scales, and (*b*) is fixed corresponding to the measured base line (B), it follows that (*a*) must stand in true relation to (A). The height of the tree is marked by the stopping of the pendulum.

Manufactured by Th. Buddendorff, Mechanic, Schützenstrasse, No. 53, Berlin, S. W.

---

WE hear with great regret that the recently established New Zealand Forest Department has been abolished, the new ministry in that country apparently thinking that the forests will last their time, and that if ruin should come hereafter on this hitherto flourishing Colony that at any rate they will not be there to see it.

---

## V. NOTES, QUERIES AND EXTRACTS.

A NEGLECTED DUTY OF GOVERNMENT.—We spoke in a recent article of the Indian theory of Government as it has always been understood by the rulers and the ruled in this country, as in all Oriental countries. Starting from the principle that the soil belongs primarily to the State, this theory requires that the people should use it in the interests of the State as well as their own, and assumes that State and people area like interested in its improvement. As regards cultivation we have before said that it is the duty of Government to insist upon the people doing their share of the improvement of the land, towards which the Government has done, and is doing, so much. Our present concern is with the waste, and especially with that portion of the waste which was once, and might be again, covered with valuable forest.

To speak first of village common in the plains. On this common depend to a great extent the village cattle. Cultivated fodder is fed to plough-bullocks and to cows in milk ; but the breeding cattle depend for sustenance mainly on the wild pasture. Restriction of this and consequent decrease of cattle, means diminution of supply of young stock, enhancement of the price of bullocks, decreased supply of manure, and consequent increased cost and diminished efficiency of agricultural operations. These are matters in which the Government is much concerned : its interests are affected, and it becomes its duty to interfere. On its own part Government is doing all it can, by promoting cattle fairs, by breeding bulls, by creating fodder reserves and experimenting in the cultivation and storage of fodder, to improve the cattle supply. In the common interest, therefore, the people should be encouraged, assisted and directed in doing the same ; and, if necessary, compulsion should be put upon them to do their share towards advancement of agriculture by protecting and improving the waste land for the support of cattle.

To this end we should—strictly in accordance with the native theory of good administration and of the relations of the Government and the people respectively to the soil—debar any breaking

up of waste land without permission. We should prescribe the reservation and improvement of portions of the village area as fuel and fodder reserves, for village use under certain regulations, and we should exercise the necessary supervision to enforce these regulations being carried out.

*But there are parts of the country where the short-sighted folly* of the people, and the neglect of the Government, have produced evils infinitely greater than merely restriction of pasture, decrease of supply of agricultural cattle, and consequent deterioration of agriculture. Hill-sides, intended by nature to be clothed with forest or bush, have been not only cleared but stubbed—not only stubbed—but indiscriminately grazed down, to the prevention of all possibility of reproduction. The results are far-reaching and lamentable. Deprived of their natural protection the hill-sides have been scoured by rain, all soil being washed off, and nothing left but bare and barren rock. Worse still, the *detritus* of this rock is carried down further and further yearly, to the destruction of fertile land in the plains below. Again, not only have these beneficent springs and streams dried up, which once were maintained by the retaining and filtering action of soil and herbage upon the rain falling on the hill-sides ; but, as these retarding agencies no longer exist, that rain rushes at once off the hill-sides into the ravines, and sweeps down them as raging torrents to work infinite mischief in the plains. What question can there possibly be, in such cases as these, of *claims* to do what is mischievous, of *rights* not only to ruin the common property of themselves and the Government, but, in so doing, to injure the common property of others and the Government? Under any theory of administration, the Government can interfere to make people take such order with their own property as not to injure that of others. But under the Indian theory of the relation of the Government to the soil, which theory has never been abandoned, it is the common property of the Government and the people—or rather, property of the Government in which the people have only a claim of "user"—which is being misused to the detriment of the Government, of the offenders themselves, and of their neighbours.

In such a case the Government is not only entitled but is bound to step in, and to take over the management of the property thus misused. At any rate it can compel the offenders to take such order with that property as shall renew the fertility of the hill-sides, shall reproduce the growth of fuel and fodder once found thereon, shall revive the perished springs and brooks, shall restore the *régime* of the streams, and reduce them from destructive torrents

to beneficent floods, and shall thus do away with the evil of sterilising deposits spread over the plains by these torrents. And where the hill-sides were clothed with valuable forests this argument applies with redoubled force. That the forests belong to the Government, is a matter regarding which there has never been any question. In some places the Government has thought fit expressly to give away its property, but where this has not been done it would occur to no one to advance any claim to the forest beyond that of certain privileges, to be allowed in so far as they are not detrimental to the forests.

But unfortunately the encroachment of the people, and the negligence of the authorities has permitted a state of things to arise which is most prejudicial to the forests. Not only are the fallen leaves carried away for manure, but the trees, however immature, are lopped from bottom to top for the same purpose, and thus deprived of the means which nature gives them whereby to breathe and feed and grow. Again the forest is grazed without respite or discrimination, by herds not only of horned cattle, but of sheep and goats. The mischief done by the close grazing of both these latter is notorious, and the goat, moreover, gnaws everywhere and nothing comes amiss to it ; even the horned cattle do much harm in their search for herbage. As was said recently at a convention in Ontario :—" If we give the cattle permission to roam amongst the trees, eating and trampling under foot the rejuvenators of the woods, breaking with horn and hoof the rising sapling, tramping the soil from the roots of the trees, and letting in the drying winds—sooner or later our forests becomes but the dried up remains of former greatness." In the same convention, composed mainly of practical farmers, strong remarks were also made, which should be taken to heart by those who see no objection to allowing the zemindar in the plains to bring every inch of bush land under cultivation. It is found that where the bush in Canada has been too extensively cleared away, " the soil has ceased to be so productive, the little streams and rivulets have dried up, greater extremes of heat and cold are experienced, and the climate becomes more variable. * * Again, we find it much more difficult to raise some of our principal crops. The pasture becomes bare and withered in early summer, owing largely to exposure, and to the hot dry winds which sweep along unchecked, and lick up the moisture from the parched soil."

As regards forest land in the hills, much has been done, and is being done, by the British Government, to protect the State property in the interests of both the Government and of the people. But

unfortunately a very large proportion of such land in the Himalaya is in the territory of subordinate governments, where not only is the zemindar not restrained from doing mischief, but the Government itself is foremost in the destruction of the property of the State. The notable case which has recently occurred in Garhwal is one of many; indeed we may apply to most Hill Chiefs the remarks which the Commissioner of Agriculture in the United States made, in 1885, regarding the lumberman :—"The farmer, having a portion of his farm only covered with trees, will almost naturally be prudent in the consumption of them, and can easily be led to see that to sweep them off at once would be to lessen the amount and injure the quality of all the crops of his cultivated field, and that in the end he would be a loser. But the lumberman is open to no such considerations. He sees in the trees, or thinks he does, so much money, and he aims to secure it by the most rapid means. The same is true of the miner. The lumberman and the miner alike cut with reckless profusion, wasting often more than they directly consume, leaving upon the ground large portions of what they cut, and breaking down and destroying much of the young wood in getting what they seek. After this the waste and broken down wood, becoming dry, is ignited by some accidental cause, and becomes the occasion of a raging uncontrollable fire, which sweeps through the forest, carrying destruction over a wide space."

Now these protected Chiefs exist by our favour, and they reign under condition of good government. To injure the State property and prejudice the interests of their own population in the way described is not good government, but actual misgovernment; moreover, they do not injure merely themselves and their people, but also their neighbours. From the clearance of their hill-sides arise all the evil consequences to the plains below which have been described as arising from the clearance of hill-sides in the British territory. Therefore the British Government is bound to interfere and to induce or compel these Chiefs to take the same measure for the protection of their forests which the Government is taking for the preservation of forests within its own territories. In the Native States, as in British districts, in the mountain, as in the plain, the right of the British Government to interfere for the protection and improvement of property held by the State for the benefit of the community, is founded on that law of the Twelve Tables, *Salus populi suprema est lex.* Against this right no private claim or prescription can be set up. There can be no prescriptive right to do mischief or to injure the common weal.—*Civil and Military Gazette.*

THE INSECT PESTS OF INDIA.—The following circular, issued by the Trustees of the Indian Museum, Calcutta, 1st February, 1888, is recommended to the attention of our readers :—

The Trustees of the Indian Museum have had under their consideration the means whereby a useful scientific examination of the insect-pests of India can be best effected. Bearing in view the great economical importance of the investigation, they have directed the first assistant, Mr. E. C. Cotes, to consider it an essential portion of his duties, and have instructed him to communicate with those interested in the subject, and those likely to aid its object, in order to ascertain the facts and collect the materials which must form the basis of all really scientific work of permanent value.

Mr. Cotes will gradually record the entire life-histories and practical methods of dealing with the principal insect-pests, publishing from time to time, as materials accumulate, the information collected, and distributing it to those interested.

It is only by the active co-operation of those who live in the districts where the insects occur, and who have actual experience of the pests, that really useful results are to be expected in this undertaking; but if all will contribute what is brought to their own knowledge of the subject, there will be no considerable difficulty in collecting complete and reliable accounts of the various pests, and hence of arriving at the most suitable methods of dealing with them.

With regard to the value of such enquiries, it is only necessary to point to the success that has attended similar work carried on by Miss Ormerod in England, and by the Entomological Commission under Dr. Riley in America, where considerable advance has been made within the last few years in methods of combating insect-pests, and in diffusing reliable information about them.

The following are the principal points upon which information is wanted :—

1. The occurrence of a pest.
2. Details of the crop attacked.
3. The extent and nature of the damage done.
4. Estimate, where easily procurable, of the pecuniary loss occasioned by the pest.
5. General particulars of the pest and its method of attack.
6. The *egg* of the pest :—
   - *a.* Description of the egg.
   - *b.* Where deposited.
   - *c.* Time taken to hatch.

d. Period of the year during which eggs are found.
e. Measures taken to destroy the egg.
f. Ichneumonidæ and other natural enemies to the egg.

7. The *larva* of the pest (grub or caterpillar) :—
a. Description of the larva.
b. Habits and localities selected.
c. Food plants other than the crop attacked.
d. Number of moults.
e. Period of the year during which larvæ are found.
f. Time taken to complete larval growth.
g. Measures taken to destroy the larvæ.
h. Natural enemies, especially birds, ichneumonid and tachinid parasites, predacious insects, and fungoid diseases.

8. The *pupa* of the pest (chrysalis or cocoon) :—
a. Description of the pupa.
b. Exact locality selected for pupating (whether on the food plant, underground, or elsewhere).
c. Period of the year during which pupæ are found.
d. Time passed in the pupal state.
e. Measures taken to destroy pupæ.
f. Natural enemies and parasites.

9. The *imago*, or perfect insect :—
a. Description of both the male and the female.
b. General habits.
c. Localities frequented.
d. Food.
e. Date when copulation takes place.
f. Period of the year during which imagos are found.
g. Date and method of oviposition.
h. Measures taken to destroy the imago.
i. Natural enemies, diseases, and parasites.

10. Alternation of generation, dimorphism, parthenogenesis, and any other points connected with the natural history of the species.

11. Other measures actually adopted for prevention, cure, their cost and effect.

12. Insecticides, especially such as contain kerosine or compounds of arsenic.

13. The history of damage done in former years, with supposed causes of immunity from attack at one time and undue multiplication of the pest at another.

14. The introduction of the pest, the supposed date of its occurrence, and the way it was introduced.

15. The spread of the pest, its direction and pace.

16. The effect of varying soil, moisture, temperature, and other natural conditions, on the pest.

Special attention should be directed to the positions selected for oviposition, pupating, and hybernating, the state (whether as egg, larva, pupa, or imago) in which the insect hybernates, the number of generations in the year, and the food plants other than the crop actually attacked, as on these preventive measures can frequently be based.

Individual observation will of course often be confined to single points in the life-history of each pest, but if these are jotted down and forwarded as they present themselves, they will frequently be of value as filling up what would otherwise be gaps in the history of the pest. The complete history may take some time to record, but when once the main facts are known about each pest, it will be easy to specify the exact information wanted to complete the record.

Each pest should be dealt with entirely separately; and observations should, in all cases, be accompanied with specimens illustrating, as far as possible, the pest and its method of attack. Specimens of the pest itself should be sent, where possible, in all stages of development and in considerable numbers; eggs, caterpillars, and other soft-bodied insects in strong alcohol or spirits of wine; chrysalids or cocoons alive and packed lightly in leaves or grass; other insects dried and pinned or wrapped in soft paper. Live insects are always preferable to dead ones, and should, in all cases, be sent where there seems to be a reasonable probability of their surviving the journey. Specimens of leaves and green plants damaged by the pest may be sent wrapped in damp cloth, grain, wood and such like being packed as occasions suggest.

Observations on economic insects should be written clearly on one side only of the paper, and sent with the specimens to Mr. E. C. Cotes, Indian Museum, Calcutta; they will be gratefully received, in all cases, acknowledged, and, so far as possible, any information about them will be given, or sought for from experts in Europe and America.

---

## MINERAL DEPOSITS IN WOOD.

At a recent meeting of the Linnean Society of London, Mr. D. Morris, of Kew, exhibited a piece of the wood of a tree, *Hieronyma alchorneoides*, in clefts of which was a hard mineral deposit, said to be carbonate of lime and alumina. He also referred to a note by Sir F. Abel, which was published in the Journal of the Chemical Society for March 1862, on the occurrence of such deposits in

teak wood. In that case the substance which Sir F. Abel had carefully analysed had been found to consist of phosphate of lime with a small quantity of ammonio-phosphate of magnesia. The analysis gave the following percentage results :—

| | |
|---|---|
| Lime, ... ... ... ... ... | 34·04 |
| Magnesia, ... ... ... ... ... | 1·86 |
| Ammonia, ... ... ... ... ... | 1·12 |
| Phosphoric acid, ... ... ... ... | 43·35 |
| Water and a small proportion of organic matter, .. | 19·54 |
| Carbonic acid, ... ... ... ... | ·09 |
| | 100 |

In some analyses of wood ashes which was made in India in 1884, by Dr. H. Warth, the Professor of Chemistry to the Forest School at Dehra Dun, the proportion of phosphates in teak wood was found to be very small.

Dr. Warth had ascertained that in 100 lbs. of steam dry teak wood there was 0·77 lbs. of ash, of which the following was the composition :—

| | | or per cent. |
|---|---|---|
| Soluble potassium and sodium compounds, ... | 0·13 | 16·88 |
| Calcium carbonate, phosphates of iron, calcium, &c., ... ... ... ... | 0·31 | 40·26 |
| Magnesium carbonate, ... ... ... | 0·21 | 27·28 |
| Silica, &c., ... ... ... ... | 0·12 | 15·58 |
| | 0·77 | 100 |

We may compare with these figures, those obtained by Mr. R. Romanis, D. Sc., Chemical Examiner to Government at Rangoon, and published in a paper in the 'Indian Forester' for February 1886. Mr. Romanis' analyses gave for teak heart-wood the following :—

| | |
|---|---|
| Potash, ... ... ... ... ... | 1·51 |
| Soda, ... ... ... ... ... | 2·82 |
| Lime, ... ... ... ... ... | 11·80 |
| Magnesia, ... ... ... ... ... | 21·97 |
| Oxide of iron, ... ... ... ... | 1·79 |
| Phosphoric acid, ... ... ... ... | 27·42 |
| Silicic acid, ... ... ... ... ... | 32·69 |
| | 100 |

a result which it is not easy to compare with that given by Dr.

Warth. Both, however, seem to agree in showing that magnesia is the principal component, and their results do not seem to clash with those of Prof. Abel for the composition of the deposit.

In 1878 some white deposit found in clefts of blackwood (*Dalbergia latifolia*) by the writer was analysed, and the result showed that it consisted chiefly of carbonates of lime and magnesia. It is to be regretted that the details of the analysis were lost. We have no information regarding the composition of blackwood either from Mr. Romanis or from Dr. Warth, but the latter's analysis of the very similar wood of the sissu (*Dalbergia sissoo*) gave 1·17 per cent. of mineral ash, of which nearly one-half, or 0·57, was carbonate of lime or magnesia.

Mr. Christy, who was present at the meeting referred to, stated that such deposits were rare in Burma wood, though common enough in teak grown in the Peninsula. It is possible that in this he is right, and that the wood grown in the more regular climate of Burma is less liable to get split or develop hollows than that grown in parts of India where the seasons show a more marked difference, still it would be interesting, if any of the readers of this Journal could supply some information on the subject. He further said, as did Prof. Abel in the paper referred to, that the deposits were often so large and so hard that the axe-men and sawyers refused to work on the logs which contained them, as the deposit damaged their tools. The writer does not remember that he has ever heard of any such case in his experience.

Deposits of mineral matter occur frequently enough in some woods besides teak. They may often be seen in that of *Dalbergia latifolia* usually in radial clefts like star-shakes, and often of considerable amount. They may be seen in sissu, in *Terminalia tomentosa*, in most of the ebonies, in *Dillenia pentagyna*, and possibly in other trees. Could some of the readers of this Journal, who may come across such things, get them analysed, so that we may know definitely what is the usual composition of the deposits in the different species, and at the same time ascertain something of their origin. Besides these comparatively large masses of mineral matter which occur in the clefts of a log, there are also somewhat similar deposits in the vessels of different species. Every one knows the curious white deposit which fills the pores of the wood of the *Strychnos Nux-Vomica* and *Strychnos potatorum;* the yellow ones in that of the species of *Stereospermum* and *Pajanelia*, and doubtless others will suggest themselves. Then there is the peculiar deposit found in bamboos, and called 'Tabasheer.' It is most common in the thorny bamboo or 'kattang' (*Bambusa arundinacea*) and the 'Moolee' of

Chittagong (*Meleranna bambusoides*), and consists of silicates of lime and potash. The whole question of Tabasheer was lately discussed by Mr. Thiselton Dyer in the pages of 'Nature,' and by Sir D. Brandis in the 'Indian Forester' for March 1887, but there is still some doubt of its real cause.

Mr. Morris also showed a 'cocoanut pearl,' a very curious and heavy pearl-like substance of about the size and shape of a hedge-sparrow's egg. This is a very rare product, and is, it is understood, much prized as a talisman by natives in the Islands of the Eastern Archipelago who find it. That belonging to the Kew Museum, presented by Dr. Hickson, is said to be one of the first that has reached England. It is found in the interior of old nuts, and consists of carbonate of lime almost pure, a section of the pearl showing hardly any structure at all.

How it is produced, and how it is valued, and for what, is a problem for those officers who in Malabar or Burma or elsewhere, have it in their power to make enquiries from the growers of cocoanut trees.

KEW,<br>*18th February, 1888.* J. S. GAMBLE.

## TREATMENT OF BAMBOOS.

It was an evil hour when I undertook to write on the reproduction and management of bamboos, little thinking at the time that I would be taken to task so severely by one of our highest authorities, in the person of Mr. Gamble. I had only hoped by my proposals to be favoured with a definite set of rules on the subject, as I said before that I was only a beginner. However, to the best of my recollection and abilities I submit the following answers, though it must not be forgotten that every rule has an exception.

*Answer* 1. "25" is the number stated by Mr. Gamble as arbitrarily assumed by me; which is quite correct, as I have no record to produce on this head, nor of the age 7 years. As I was not in the Forest Department my observations were not noted in any book. There may be 30 or 40 culms per clump at this stage of the age of planted bamboos, but it must be taken into consideration that the ones planted have many advantages over those growing wild in a forest. Mr. Gamble says some bamboos were planted at Bamunpokri, and in 5 years they were of workable size. What was the average number per clump then, should be known? I do not think there can be at the present day more than 50 to 60 bamboos per average clump. So to be on the safe side, and as the cuttings are

in the forest and not in a plantation, I said 25, when the clumps are about 7 years old.

With regard to species, I beg to say that I do not know the scientific name; we call it Bhalka or Bara Bans of the Lower Bengal (Jessore and Hazáribágh). I have not taken any particular note, as I said before I was not in the Forest Department, and did not at the time think it necessary to note the annual shoots, but this much I must say, that when new stems are thrown up from the rhizome of a planted bamboo off-shoot, for the first year only *one* appears, or at the utmost two, and in *no* case more than this number, with no greater size than 2 to $2\frac{1}{2}$ inches in girth at 3 or 4 feet from the ground : the parent of this shoot may have been 8 to 10 inches in circumference. The second year, three or four more of about 5 or 6 inches ; the third year, the culms are six or seven in number, with a girth of 7 or 8 inches, or even the size of the planted mother stool. Then on the 5th year how many would be fit for cutting? Hence, I said 7 years would be about the best time, considering we have to deal with forest growth.

*Answer* 2.—Eight bamboos being the average growth per clump per year, not of planted but of wild forest bamboos, (those planted would give much more, as I have said in my 7th proposition in December Number,) of an average clump containing 25 culms. Here again to be on the safe side, I said to cut eight bamboos yearly, though it would scarcely be concluded that all the clumps in the forest were comprised of 25 culms, and that they only throw up eight shoots yearly. To argue a thing for the sake of argument is one thing, but if one had to examine the forests in Palamow, it would be found that the average growth per clump would come to about eight culms annually, and instead of closing the block for a time, one may go on cutting indefinitely eight every year, so long as a clump of 25 bamboos produces an average annual growth of eight culms, as I have already said in my proposition 3, which I here give for ready reference. "Thus, clumps forming 25 to 30 culms can bear removal of eight to ten bamboos annually with advantage, and above this number, average growth *per clump per year must first* be estimated." Now the object of my saying 7 inches in girth is to safe-guard a younger clump which may have got 25 bamboos, but has not attained the full size, such as are found in Chuttra and Kunda in the Hazáribágh district, in the Eastern Siwaliks between Hardwar and Dholkand in the Saháranpur Forest Division, N.-W. Provinces, and Bettah, Saidope and Ramandag ranges in the Palamow Forest Sub-Division, Chota Nagpur.

*Answer* 3.—The clumps of Bettah, Ramandag and Saidope ranges in the Palamow Forest Sub-Division yield at an average per clump per year eight culms as stated above.

*Answer* 4.—My object was to leave 2½ feet, and as the coolies in Palamow did not understand this well, I mentioned three nodes, which is as close as one could expect for 2½ feet, and my reason was chiefly "reproduction." Every one knows that cutting flush to the ground means weakening the rhizome, which, if continued, means death at last; on the contrary, high cutting does not dry up the stool for a long time, but low cutting does, and very soon too. I may here as well add by way of proof, that when one plants out bamboos the off-shoots are 4 to 5, or even 6 feet long—why? To ensure living of course, and on this I hold that high cutting is beneficial to reproduction, and I believe for this very reason too those planted in Bamunpokri during 1877-78, if I mistake not, were about 4 or 5 feet long.

*Answer* 5.—My reason is as I have stated, with this addition, that when I said cutting immature shoots kills the clump, I did not mean to say in one generation, certainly not, but in two or three, or more; though death is eventually certain. Sir D. Brandis says that it weakens the rhizome; it then throws out for a series of years only thin stems. Now if these thin stems are cut down as they come up, what follows? Weakness and death at last. So my object in saying nothing under 7 inches in girth should be cut, is to be on the safe side.

*Answer* 6.—The reason for the removal of dry culms is, as Mr. Gamble has already said, merely to help regeneration. Should the dry stools be left, insects appear which not only devour the rotten bamboo, but very often eats up the germ of the rhizome, for which I have seen natives of Lower Bengal fire their bamboo clumps annually, in the belief that it not only kills all destroying agents, but helps to hasten plentiful reproduction. This idea may be wrong, but burnt earth with leaves and dry bamboo ashes makes capital manure, and should assist reproduction.

*Answer* 7.—I must repeat that what I have said, I have seen without taking any particular notice, or recording the result of any experiment. I saw the treatment of bamboos as practised by natives in Jessore and Hazáribágh, and hence suggested those seven propositions, hoping to be put right, where I may have been wrong.

One point more I wish to bring forward with regard to cutting of young shoots for basket making, &c. I should think it was the Tulda bamboo which is used for this purpose, and not Bhalka, and

the cutting of these young shoots may be avoided if the bamboos are cut and dried for eight or ten days in the sun; then kept under water, or, better still, in clay, for about a fortnight or so, when they become as pliable as shoots five or six months old.

CAMP GOSHEHAT,
*27th March, 1888.*

J. C. MENDES.

## MEMORANDUM ON DATE CULTURE,

### SUBMITTED TO THE MEETING HELD AT JEYPUR IN CONNECTION WITH FLOWER SHOW HELD ON 10TH MARCH, 1888.

ON *the suggestions* of Government that dates are useful trees in times of famine for the poor people to live upon their fruits, the State Council of Jeypur desired to have some experiments in this locality. Brigade Surgeon E. Bonavia, who has studied its culture, and who reared several date trees at Lucknow for Government, was addressed on the subject. He replied that its culture in Jeypur was not only desirable, but useful and possible, as the dry and sandy soils of Rájputána were suitable for its introduction. His letter was considered interesting and instructive. It was *therefore published and distributed to some of the nobles and officials* of the State for general information.

The Forest officer was deputed to Lucknow and Sahâranpur, to inspect dates cultivated in those places. On his return he drew out certain instructions, which were published in vernacular, and distributed for general information. Mr. J. F. Duthie, B.A., Director of Botanical Department of Upper India, supplied some 24 maunds of Tunisian date stones in the last year. They were tried by several gentlemen and officials :—

About three maunds of date stones were sown *in Ram Newas'* garden, and some 7,000 seedlings were, as an experiment, transplanted at Amanishah, Bhakhri and Kalegh Sagar Bunds after three months. Unfortunately there was unusually heavy rain last year, hence a considerable number of seedlings died, but some of them however, survived, and are doing well. Some of the gentlemen who tried date stones write as follows :—

Thakúr Sawant Singh of Bagru writes—that he sowed about two maunds of date stones. Some 4,000 seedlings germinated, but on account of the heavy rains, most of them died. He has still some 1,700 seedlings in his estates. Each of these seedlings had in last October three or four leaves.

Thakúr Hari Singh of Shekhawat writes—that he cultivated dates in Haripur, Kheri, and Taradu of Shekhawati in the month of July. The soil at Kheri is saline, and the water in wells in Taradu is deep, being about 60 feet below the surface. He has in these three villages some 1,400 plants, which are doing well, specially at Taradu, which is otherwise destitute of all kinds of trees. The plants, he adds, are about a foot high, and have five or six leaves on them, except in hilly places, where they have only about two, and the height of plants is also less. They are watered twice a week.

The Rev. G. Maclister, M.A., says—"I have much pleasure in saying that I sowed the date seeds and that most of them germinated. I sowed them in two beds, there are nearly 200 altogether. I transplanted about half a dozen of them, putting them about 4 yards apart; three of these are alive and vigorous. I also planted one in a large box, and it is now the largest and finest plant I have. I also planted five in flower pots, and these are all alive and doing well. I hope to transplant all those that are still in the beds, at the proper time, and I am glad to be able to express the hope that so far as I can see there is every likelihood of their doing well."

Rám Nath Singh, Head Master of Noble School, Jeypur, says—that he has about 500 seedlings in his village in Shekhawati; they are doing well, and have each of them some five or six leaves. The soil is sandy and contains some manure, and the plants are watered twice a week.

The Superintendent of Baghat writes—that the date stones sown by him germinated fairly and are doing well. They have got some two or three leaves on each plant.

Babu Sukh Lál and Munni Lál of the Engineering Department state—that they have got some 3,635 plants on different bunds under their charge.

The date stones sown at Bhat ka Bagh, Amanishah and Madhopur, as well as in the Forest office compounds by the Forest Department, germinated freely, and are doing well. They were sown in July in small beds, and irrigated twice a week. They had a good start at the outset and are about a foot in height. The soil is sandy, free, but poor. They have now about their fourth leaf out, though some vigorous ones have got their sixth. They are altogether in number 3,500.

To encourage date culture in this State, the Council, on the recommendations of Lt.-Col. S. S. Jacob, Executive Engineer, sanctioned the award of prizes at the rate of 6 pies per plant per annum

to those cultivators who would try them in Crown lands. The Irrigation Muhafizan (*i.e.*, Sepoys) are also eligible for such prizes. The officers of the State, who would take special interest in the encouragement of its cultivation, will be given certificates by the Durbar.

SADHU SINGH,
*Forest Ranger.*

## *RHYNCHOTA* OF INDIA.

I HAVE undertaken for the Asiatic Society's Journal, a catalogue with descriptions of the *Rhynchota* of India, and would ask your co-operation in procuring specimens, of which duplicates will eventually be deposited in the Indian Museum. I shall be ready either to make exchanges of this or other orders, or name collections, so far as the materials at my disposal will allow. The order *Rhynchota* is of considerable economical and physiological importance, and to render the catalogue of permanent value, I would ask the co-operation of workers in other branches of Natural History to collect and furnish specimens that will enable me to adequately set forth our Indian fauna which is particularly rich in this order. The species will be readily recognized by the presence of a proboscis or beak either porrect between the antennæ, or curved, or resting quiescent on the sternum beneath. Some resemble butterflies and moths, others are like beetles, and many emit a strong aroma when alarmed. I would ask that where possible the month of capture be added to the locality, as it is desirous to accumulate data as to appearance.

Mr. W. L. Distant is preparing for the Trustees of the Museum a monograph of the *Cicadidæ*, belonging to this group, and so well known for the shrill cry of the male on trees in the rains. This will be illustrated by figures of each species, and it is desirable that as many species as possible should be procured so as to make it tolerably complete; any sent to me to the undermentioned address, or direct to Mr. Distant, at 1, Russell Hill Road, Purley, Surrey, will be thankfully acknowledged. For catching these insects, the ordinary net may be used, and for killing them the poison-bottle. A Keating's lozenge bottle is found useful, in which place a mixture of one part of cyanide of potassium and eight parts or thereabouts of plaster of Paris, gumming a piece of paper over the mixture to retain it at the bottom. About half an inch of this mixture will remain efficient for a long period. Another way is to place the

captures simply in spirits of wine, but the first plan is more effectual for the larger species. The insects can then be pinned in boxes or simply kept in spirits of wine, and can be sent by parcel post in thin wooden boxes or old biscuit tins packed in paper, leaves, or moss, in layers. These boxes may be sent bearing to the undermentioned address. Any further information required I shall be happy to furnish so far as I can.

E. T. ATKINSON.

18, STORE ROAD, BALLYGUNJ,
CALCUTTA,
*2nd February, 1888.*

*P.S.*—Mr. de Nicéville would be glad to correspond with collectors of Butterflies.

14-1 SUDDER STREET, CALCUTTA,
*17th February, 1888.*

Vol. III. of "the Butterflies of India" is in active preparation.

---

## MEMORIAL OF THE CORPORATION OF SOUTHAMPTON.

THE Memorial of the Corporation of Southampton, which it is hoped will have the co-operation of most of the other local bodies in Hampshire, has recently been sent to the Lord President of Her Majesty's Privy Council. This sets forth—

*1st.* That your Memorialists are much interested in the general subject of Practical and Scientific Forestry, in the preservation and greater utilization of the Crown forests, in general improvements in the methods of growth of timber and underwood, and in the acclimatisation in England of foreign trees of economic value.

*2nd.* That your Memorialists have heard with much interest of the proposed establishment of a National School of Forestry for England, at which Indian and Colonial pupils in Forestry could also receive instruction.

*3rd.* That the following Crown forests are situated in Hampshire and the Isle of Wight:—

(*a*). The New Forest, comprising about 63,000 acres, by far the most extensive forest in the United Kingdom, of which by Act of Parliament 16,000 acres can at any one time be closed for planting, while the remaining 47,000 acres, on which trees may be growing, are at any one time to be left unclosed.

(*b*). Woolmer Forest, now enclosed and free from Common rights.
(*c*). Alice Holt Forest, now enclosed and free from Common rights.
(*d*). Beer Forest ,, ,, ,, ,,
(*e*). Parkhurst Forest ,, ,, ,, ,,

There are also Harewood, Pamber, Stanstead and other extensive forest lands in private hands.

*4th.* That these Crown Forests are situated on the following geological formations:—Lower greensand, gault, Upper greensand, chalk, Reading beds, London clay, Lower Bagshot, Bracklesham and Upper Bagshot beds, Barton clay, Headon beds, Hempstead beds, drift, gravel, alluvium and bog, and that consequently they contain almost every variety of soil for timber growth, and upon selected areas of which experimental plantations with a view to the acclimatisation of suitable foreign trees of economic value and adapted for special soils might be easily carried out.

*5th.* That large areas of the New Forest are especially in want of scientific Forestry, the trees in many parts of the forest being rapidly decaying, owing to the restrictions applied by existing Acts of Parliament.

*6th.* That the climatic advantages of the forest parts of this country make it admirably adapted for the growth of timber and for a great variety of work in practical Forestry.

The prayer of the Memorial is therefore that the proposed National School of Forestry may be located in Hampshire.

*St. Andrews, Scotland.* GEORGE CADELL.

## BOARD OF FORESTRY.

In view of the Board of Forestry which the Committee of the House of Commons recommended should be established in Great Britain, and the probable functions which it will be called upon to fulfil, it is interesting to notice the various views expressed regarding its probable usefulness by the writers of the annual reports of the position and prospects of the landed interest in the various counties of England.

Thus the report on Gloucestershire states—

"There has been no planting of forests or trees to any extent about here for the last 17 or 18 years, and there is scarcely any part of an estate in this neighbourhood and others where the woods are not neglected. The subject does not appear to be understood. There are doubtless

hundreds of acres of inferior land at the present time totally unfit for any other purpose except planting, and which would by judicious management amply repay the owner in years to come. The proposed School of Forestry, if properly conducted in a practical manner, would undoubtedly be of much benefit, and it would be the means of arousing the attention of owners to this important subject."

In South Devon it is considered that the School of Forestry will meet a want which has long been felt, and that not only woodlands may be made more remunerative, but that paying crops of timber may be raised on lands which are not now cultivated.

The writer on East Sussex finds the rates and taxes an insurmountable burden on the profitable growing of wood. The copse wood in that district is cut every 10 or 12 years, and in the present tate of depression realizes not more than £5 an acre, while the rent, rates and taxes are placed at not less than 12 shillings an acre.

In Herefordshire the "woods are as a rule left to manage themselves," a species of "home rule" which does not appear to be very satisfactory. While in counties bordering the sea, Baltic and other timbers are offered at a price far too low to encourage the cultivation of home grown plantations.

*St. Andrews, Scotland.* GEORGE CADELL.

---

## IMPERIAL FOREST SCHOOL, DEHRA DUN.

THE results of the Final Examinations of the Senior Ranger's Class, which were read out by the Director on the 21st March, were as follows. The names are given in alphabetical order—

*Obtained Ranger's Certificate from 19th March.*

| | |
|---|---|
| Hanumantha Rao, | Northern Circle, Madras. |
| Madho Pershad, | School Circle, N.-W. Provinces. |
| Malaya Pillai, | Southern Circle, Madras. |
| I. G. F. Marshall, | " " " |
| Nagraju, | " " " |
| Pandurang Narain, | Berar. |
| Saldanha, | Southern Circle, Madras. |
| Shoradindo Gosami, | Assam. |
| G. H. Wittenbaker, | Berár. |

*Obtained Forester's Certificate.*

| | |
|---|---|
| Nikunja Behari Nandi, | Bengal. |
| Eggya N. Shastri, | Southern Circle, Madras. |

*Vernacular Class, Forester's Certificate.*

| | |
|---|---|
| Badri Datt, | Central Circle, N.-W. Provinces. |
| Gaja Dhár, | " " " " |
| Hans Ráj, | Private Student. |
| Jagbandhan Singh, | Rewah State. |
| Madho Rám, | School Circle, N.-W. Provinces. |
| Manwar Singh, | Central Circle, " " |
| Natha Singh, | Punjab. |
| Randaman Singh, | Rewah State. |
| Sheikh Chand, | Central Provinces. |
| Jot Rám, | Central Circle, N.-W. Provinces. |

These Certificates date from 15th December, 1887.

| | |
|---|---|
| Rastamji, | Pertábgarh State, on 23rd March, 1887. |

## EDIBLE LICHENS.

In August 1886, Mr. Brougham, Assistant Conservator of Forests at Bellary, drew attention to a lichen called in Telugu 'Ratha pu' or 'rock flower,' which is used as food by the inhabitants of that hot district and considered to be a delicacy. It has been submitted for identification to the authorities at Kew, who pronounce it to be a species of *Parmelia* near *perforata*, Ach. Lichens are often used as food in time of scarcity in North Europe, but it is interesting to find a case of the kind in India. Can your readers call to mind any other cases?

J. S. G.

## ORGANIC CHEMISTRY AT COOPER'S HILL.

We hear that Viscount Cross has sanctioned the annual expenditure of £105 in order to afford the Forest students suitable instruction in Organic Chemistry, and in a Note by the Under-Secretary of State on the subject of Forest education at Cooper's Hill, we read with pleasure that in every other respect the course of studies seems to have been of a nature to fit the young men who pass out from the College for the duties they will have to perform when appointed to the service in India. This gratifying result is due in large measure to the care which Sir A. Taylor has devoted in the supervision of the new arrangements, and to the intelligent industry with which Dr. Schlich has performed the functions entrusted to him.

## IV. Notes, Queries and Extracts.

Conifers.—The Southern or Pitch Pine.—*Nomenclature.*—This is the *Pinus Australis* of Michaux, otherwise the southern pine, from its abundance in the Southern States of America. From being a well-known and a useful tree it bears a full crop of names. In the Southern States it is known as the long-leaved pine, yellow pine, pitch pine, and broom pine; in the Middle States as the yellow pine and the pitch pine; and in the Northern States as the southern pine and the red pine. In England it is known as pitch pine, and is generally associated with the place of export, as Darien, Pensacola, Savannah, &c.

It is scarcely necessary to say that its name, "pitch pine," is drawn from the prolific manner in which it furnishes resinous products, a detail in which it has no equal in the vegetable kingdom.

*Geography.*—The *P. Australis* is a native of the United States, from North Carolina to Florida, abounding in extensive forests near the sea coast. Towards the north it first makes its appearance near Norfolk, in Virginia, where the pine barrens begin.

It seems to be especially assigned to dry, sandy soils, and is found, almost without interruption, in the lower part of the Carolinas, Georgia, and the Floridas, over a tract of more than 600 miles long, from north-east to south-west, and more than 100 miles broad, from the sea towards the mountains of the Carolinas and Georgia. Where it begins to show itself towards the river Nuse it is associated with other trees, but immediately beyond Raleigh it holds almost exclusive possession of the soil.

With few exceptions, notably the scrub oak, this pine forms the unbroken mass of woods which covers this extensive country, and is the only tree capable of existing on this dry, sandy soil.

Captain Hall, in his "Sketches in Canada and the United States," No. xxiii., says:—

"Upwards of 500 miles of our journey lay through these desolate forests, occasional villages gave some relief to the tedium of this part of the journey, and wherever a stream occurred the

fertility of the adjacent lands was more grateful to the eye than I can find words to describe. Once or twice, in travelling through the State of Georgia, we came to high knolls, from which we could look over the vast ocean of trees, stretching without a break in every direction as far as the eye could reach; and I remember upon one of these occasions thinking that I had never before had a just conception of what the word 'forests' meant."

The largest specimens of this pine are found in East Florida.

*Description.*—The *P. Australis*, or pitch pine, is a tree from 60 to 100 feet high, and with a trunk of considerable size, retaining its diameter with very little diminution for two-thirds of its height. The bark is somewhat furrowed, and the epidermis, or outer skin, detaches itself in thin transparent sheets. The leaves are about 1 foot long, of a brilliant green, and collected three in a sheath.

The timber is less associated with sapwood than most species of fir. The concentric circles, in a trunk fully developed, are close, and at equal distances; and the resinous matter, which is abundant, is more uniformly distributed than in the other species. Hence the wood is stronger, more compact, and more durable; it is, besides, fine-grained, and susceptible of a high polish. These advantages give it a preference, as a timber tree, over every other American pine, but its quality is modified by the nature of the soil in which it grows.

In the neighbourhood of the sea, where only a thin layer of soil reposes on the sand, it is more resinous than where the soil is four or five inches thick, and the trees which grow upon the first-mentioned soil are called pitch pines, as if they were distinct species. In certain soils its wood contracts a reddish hue, and it is for that reason known in the dockyards of the Northern States by the name of the red pine. Wood of this tint is considered the best, and in the opinion of some shipwrights it is more durable on the sides of vessels, and less liable to injury from worms than oak.

The wood, generally speaking, is of a reddish white colour, clean, hard, rigid, highly resinous, regular and straight in the grain, and, compared with most other pines and firs, is rather more difficult to work; it is good in quality, and considered to be durable.

This question of durability is in a very unsettled state. There are numerous architects and civil engineers who rigidly adhere to the use of Memel and Danzig fir, and who will not allow the use of pitch pine, whilst there are others who freely use it upon all occasions.

Practical men may be found who maintain that it speedily decays in ground flooring, beam ends in walls, piles, &c., whilst there are others who rank it almost with the oak, and state that in piling, and in jetties, exposed to the tides and weather, it will last double and treble the time allotted to Memel and Danzig fir.

*Properties and Uses.*—One of the principal uses to which the pitch pine is applied is that of masts and spars for vessels, a purpose in which it has made marvellous headway, although its weight is somewhat against it. So great and general is its use that it has almost extinguished the old Riga and Danzig trade in this useful class of wood.

The longest, cleanest, and straightest logs of pitch pine are selected at the ports of shipment as "mast pieces," and sold at special prices; they range from 100 to 130 cubic feet in contents.

The use of iron and steel masts is interfering with the pitch pine mast trade; but still there is a large number of pitch pine logs used for this purpose at the principal ports of Great Britain.

Next to the oak it is the wood that most enters into church, school, and house fittings, the better or figured specimens finding free use at the hands of the cabinet-maker.

In heavy work it is largely used as beams and planking in vessels, as beams and heavy timbering in buildings, and as pump rods, framework at the pit mouths of collieries, blocks for wood paving, &c.

In America it is largely used, four-fifths of the houses, except the roofs, in Georgia and Florida are built of this wood.

In furnishing resinous products, the pitch pine is the most important tree in the world. The firs of Europe, so long celebrated for their productive powers in this branch, have surrendered at discretion in presence of the pitch pine of the Southern States of America.—*Timber Trades Journal.*

---

The American Spruce Fir.—*Nomenclature.*—This is the *Abies nigra* of our botanists, the black or American spruce fir. It derives its popular name from the dark sombre hue of its foliage, combined, no doubt, with the dark or blackish colour of its bark. This tree is called *epinette noir* and *epinette a la biere* in Canada, double spruce in the district of Maine, and black spruce in Nova Scotia.

*Description, &c.*—The American spruce fir is a tall tree, attaining in America the height of 70 feet or 80 feet, though the trunk

is seldom more than 1 foot 3 inches to 1 foot 8 inches in diameter. The trunk is smooth, remarkably straight, and diminishes regularly from the base to the summit, which is terminated by an annual lance-like shoot 1 foot or 1 foot 3 inches long. The bark is smooth and blackish. The rate of growth is more rapid than is the case with other spruce firs.

This tree is a native of the coldest regions of North America, but is most abundant in the countries lying between 44 degrees and 53 degrees North latitude, and between 55 degrees and 75 degrees West longitude, *viz.*, in Lower Canada, Newfoundland, New Brunswick, Nova Scotia, the district of Maine, Vermont, and the upper parts of New Hampshire, where it is so abundant as to constitute a third part of the native forests. Further south it is rarely seen, except in cold and humid situations on the top of the Alleghanies. It is sometimes met with in the white cedar swamps near Philadelphia and New York. The finest forests are found in valleys where the soil is black, humid, deep, and covered with a thick bed of moss, and where the trees, though crowded, so as to leave an interval of only 3 feet, or at the most 5 feet, between the trunks, attain their greatest height.

*Properties and Uses.*—The black spruce, according to Pursh, is of "great mechanical use in America, besides being the tree of which that wholesome beverage called spruce beer is made." Michaux says—"The distinguishing properties of the black spruce are strength, lightness, and elasticity." In the dock yards of the United States the spars are usually of black spruce from the district of Maine; and it is exported in great quantities for the same purpose to the West Indies and Liverpool. The knees of vessels at Boston and in the district of Maine are sometimes made of the base of this tree and one of the principal roots, and it is substituted for oak in many places where the timber of that tree is becoming scarce. It is sometimes used for floors, for which purpose it is found tougher than the white pine (*P. Strobus*), but is more liable to crack. In all these regions, particularly in Maine and New Brunswick, the black spruce is sawn into boards of considerable width, which are sold a fourth cheaper than those of white pine, and are exported in great quantities to the West Indies and to England, being used in the latter country, principally at Birmingham and Manchester, for packing cases. This species is not resinous enough to afford turpentine as an article of commerce, and the wood snaps when burning like that of the chestnut.

Thomas Laslett, in his admirable work, "Timber and Timber Trees," says the white spruce are the only deals shipped to this

country from Canada as a clearly defined class, all others being simply known here as Canadian, St. John's, &c., spruce.

The London market was supplied with about 1,100,000 spruce deals in 1871, 1,080,000 in 1872, 2,000,000 in 1873, and the immense quantity of 2,300,000 pieces in 1874, prepared generally in dimensions of 3 inches thick, 9 inches broad, and 12 to 21 feet in length. The bulk of these were sorted by brackers previous to shipment into 1st, 2nd, and 3rd qualities. Those of the 1st quality are perfectly clean, sound, and free from knots, sap, and defects ; the 2nd quality is also sound and tolerably clean, but includes deals with a few knots and sap upon the edges ; while the 3rd quality includes and admits all the faulty and coarser descriptions of deals, and some of them are very rough indeed.

The American black spruce is a harder class of wood than the European spruce, and it is more subject to loose knots, which shrink and fall out when converted into boards, flooring, &c. The geographical position occupied by the two classes of spruce influences their use in Great Britain, the Baltic spruce being almost wholly used on the east coast and the Canadian spruce on the west coast, the price of one influencing that of the other. —*Timber Trades Journal.*

---

THE TIMBER TRADE.—The following is an extract from the "Morning Post" :—

So many applications from all parts of the country, for chips from trees felled by Mr. Gladstone, have been received at Hawarden Castle, that the following printed circular has been issued in reply to such requests :—

"In reply to your letter to Mr. Gladstone, I have to say that in consequence of the number of similar requests, it has been found necessary to make in all cases a uniform charge for the wood referred to, *viz.*, 1*s.* 6*d.* for a small log, or 3*s.* per cubic foot. Applications should be made to the Bailiff, Estate office, Hawarden, Mr. Chester, who will attend to any order so far as he may have the required material at hand."

*Rhymes for the Times—The Sacred Chips.*

Come hither, come hither ye teachers
  Of the Gladsto-Hibernian creed,
Ye Radical spouters and preachers
  Come hither, come hither with speed ;
Parnellite whips, conductors of trips,
  Leaders of every grade ;

Come press your lips, to the sacred chips
  Which fall from our William's blade.
Trunks immense, no false pretence;
  Genuine branch or root,
A nice small log for your eighteen pence,
  Or three shillings the cubic foot.

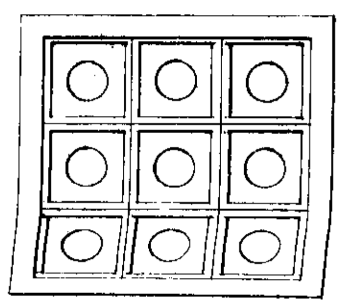
Alas! for unfortunate dealers
  In furniture costly and quaint,
In miracle workers and healers,
  In relics of martyr and saint,
Bones will be cheap, nails they may keep;
  Teeth will be simply dross.
With a Gladstone chair, what shrine would care
  For a piece of the Holy Cross?
No fraud or tricks, no common sticks
  All tastes we hope to suit
With a nice small log, for one and six,
  Or three shillings the cubic foot.

---

## THE BIJNOR THANDA TOKRI.

THIS is an invention of the well-known sportsman Mr. Markham, Collector of Bijnor, and any one who has been out with him will gratefully remember the icy cold milk and soda-water with which he regales his guests, in the blazing plains of Bijnor.

Many sportsmen have already copied the pattern of the Thandá Tokri, but one of Mr. Markham's guests, in grateful memory of his cool drinks, and thinking of his brother officers engaged in fire conservancy during the hottest time of the year, has sent us the following description of it, in order to make it more widely known. The annexed diagram shows how the basket should be made, the frame-work being of very open bamboo lattice-work, and lined outside and within with khus-khus, including the lid and bottom.



Each compartment is also thickly lined with khus-khus so as merely to allow room for a bottle.

The basket can be taken on a water-proof or tarpaulin, on the back of an elephant, and is watered from time to time, and keeps the liquor contained in it as cool as if it were iced.

THE

# INDIAN FORESTER.

Vol. XIV.]  June, 1888.  [No. 6.

## THE GRAZING QUESTION IN JAUNSAR.

JAUNSAR-BAWAR originally formed part of the Sirmúr or Nahan State. In 1807, it was conquered by the Gurkhas, from whom it was wrested by the British, in 1815. Its area is about 477 square miles, of which about 30 square miles under cultivation support (excluding the station of Chakrata) some 40,000 inhabitants. The parganna is divided into two parts, that near the plains, which is pretty thickly populated, and where bare hill-sides form a prominent feature in the landscape, and the other or northern portion, where the inhabitants are fewer, and where the largest masses of forest are situated. For administrative purposes, it is divided into 39 'khats,' a 'khat' being a collection of village communities, and the unit, in the present land settlement. This division into 'khats' was formally recognised in 1860, and the right of Government to the ownership of all waste land was protected by a rough limitation of the rights of each 'khat' in the waste land included within its boundaries.

In 1865-66, the attention of Government was drawn to the forests by the Inspector-General of Forests, and also by the proposal to establish a Military Cantonment at Chakrata. In settling the forests with regard to villagers' privileges therein, the position of their former compatriots in Sirmúr and their neighbours in Native Garhwál was borne in mind, and the rights of the governing power have been taken as similar to those held in the Native States, rather than determined by a careful study of usages, which had been allowed accidentally to obtain force since our occupation of the country.

Three classes of forests were formed—

1st Class.—Forest areas, in which the rights of Government are absolute.

2nd Class.—Forest areas under the control of Government, but subject to the exercise of certain privileges by the villagers.

3rd Class.—Forest, or waste land, made over in full proprietary right to the different khats barring the right to sell forest produce.

The first class calls for no explanation. The second class, which embraces by far the greater part of the Government forests, was considered necessary, from the inhabitants in one way or another having had the free run of the whole forest area since our rule began. The third class was formed for land which, from its vicinity to cultivation, it was inadvisable, or useless, to place under the immediate control of Government, and in which a permanent increase to existing cultivation was hoped for. Later on, large tracts of precipitous ground, entirely or nearly bare of forest, were also included in this area, and the whole was made over in full proprietary right to the villagers in 1873, as compensation for the more definite limitation of their privileges in the Government forests. The demarcation of the forests had, therefore, to be taken up 'khat' by 'khat' and not as a whole. After the examination of a 'khat' two points had to be decided—

*1st.* If there was waste land of sufficient area to warrant the reservation of a portion as Government forest.

*2nd.* If that area was large enough to admit of any of its being placed in the first class.

For example, in selecting a second class forest in a khat containing some two or three square miles of oak forest interspersed with cultivation, and in which nearly all the trees were lopped for fodder, save under exceptional circumstances, no area was marked off as Government forest.

The villagers have general grazing privileges in the second class forests of their khats, and in certain specified instances, in similar forests of other khats, but the Forest officer, with the sanction of the Superintendent of the Dun, has the power of closing some of these forests until reproduction is ensured. The villagers are responsible for any fires which may occur in second class forests, protected from fire, but open to grazing, and should a fire, take place and they cannot prove that it was caused by villagers of another khat, they are liable to fine. The responsibility of protecting the forests against the straying of cattle, when going in exercise of any right through 1st class or closed 2nd class forests to water,

cultivation or grazing areas, rests with the Forest Department, as does also the responsibility of fencing those portions of forest which run into the village cultivation, so as to render it difficult for the villagers not to prevent the trespass of cattle.

In fixing the land revenue under the late settlement, cows, bullocks and buffaloes were assessed at one anna per head, sheep and goats at a quarter of an anna each. None of this revenue is credited to 'Forests,' though the animals chiefly graze in the 2nd class forests. The domestic cattle are of the small black and red short-legged breed found throughout the hills, and are inferior to the plain's cattle in size, strength, and as milch animals. The sheep on the contrary, are superior to those in the plains, and produce excellent mutton. Both have increased very considerably of late, and from the following statistics it does not seem as if forest conservancy had too greatly constricted the grazing area.

| Year. | Number of horned cattle. | Number of sheep and goats. |
|---|---|---|
| 1850, .. .. .. .. | 10,870 | 27,200 |
| 1860, .. .. .. .. | 32,900 | 50,100 |
| 1883, .. .. .. .. | 35,270 | 54,860 |

The largest areas of closed forests are in the Deoban range, which has to supply timber and fuel of Chakrata. If we analyse the accompanying list of cattle in the different khats of this range, we find that in spite of the areas which have been closed, those khats, where both open and closed Government forests exist, are still best off for pasture.

*List of Cattle in the Jaunsár khats of the Deoban range.*

| No. | Name of khat. | Cows. | Bullocks. | Buffaloes. | Sheep. | Goats. | Number of grazing units. | Grazing area including waste land and open Government forests. | Number of acres per grazing unit. | No. of grazing units per adult cultivator. |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Harípúr Bias, | 130 | 109 | 30 | 25 | 22 | 794 | 1,913 | 2·4 | .. |
| 2 | Pánjgaon, .. | 750 | 610 | 41 | 437 | 868 | 4,910 | 6,853 | 1·4 | 17·8 |
| 3 | Bána, .. | 319 | 307 | .. | 228 | 773 | 2,566 | 3.636 | 1·4 | 13·1 |
| 4 | Leli Gothan, | 544 | 488 | 14 | 368 | 715 | 3,733 | 4,206 | 1·1 | 10·9 |
| 5 | Leli, .. | 1,218 | 1,026 | 48 | 923 | 1,292 | 8,065 | 8,746 | 1·0 | 13·2 |
| 6 | Koru, .. | 547 | 867 | 73 | 297 | 724 | 4,921 | 5,085 | 1·0 | 9·4 |
| | Carried over, | 3,508 | 3,407 | 206 | 2,278 | 4,394 | 24,989 | 30,439 | 1·4 | 10·7 |

*List of Cattle in the Jaunsár khats of the Deoban range*—(continued).

| No. | Name of khat. | Cows. | Bullocks. | Buffaloes. | Sheep. | Goats. | Number of grazing units. | Grazing area including waste land and open Government forests. | Number of acres per grazing unit. | No. of grazing units per adult cultivator. |
|---|---|---|---|---|---|---|---|---|---|---|
| | Brought forward, | 3,508 | 3,407 | 206 | 2,278 | 4.394 | 24,989 | 30,439 | 1·4 | 10·7 |
| 7 | Lilgaon, .. | 1,096 | 527 | .. | 671 | 1,777 | 6,505 | 5,915 | 0·9 | Figures not available |
| †8 | Semalta, .. | 316 | 312 | .. | 233 | 259 | 2,062 | 1,914 | 0 9 | |
| †9 | Athgaon-Chandu, .. | 347 | 200 | .. | 199 | 620 | 2,186 | 3,291 | 1·5 | |
| †10 | Bangaon, .. | 1,015 | 357 | 27 | 324 | 1,263 | 5,152 | 7,085 | 1·4 | |
| †11 | Udpálta, .. | 335 | 383 | 4 | 129 | 454 | 2,398 | 2,156 | 0·9 | |
| †12 | Birman, .. | 683 | 311 | 12 | 329 | 525 | 3,399 | 2,299 | 0·7 | |
| *13 | Bamtár, .. | 777 | 901 | .. | 648 | 1,231 | 6,074 | 9,488 | 1·6 | 11·3 |
| *14 | Mohna, .. | 444 | 250 | .. | 488 | 544 | 2,767 | 4,244 | 1·5 | 20·8 |
| *15 | Dwár, .. | 467 | 225 | 21 | 637 | 729 | 3,201 | 6,429 | 2·0 | 24·4 |
| *16 | Bislár, .. | 1,038 | 327 | 19 | 1,167 | 1,332 | 5,956 | 8,032 | 1·3 | 25·3 |
| *17 | Kailo, .. | 537 | 277 | .. | 808 | 828 | 3,671 | 7,684 | 2·1 | 23·4 |
| *18 | Missan, .. | 483 | 402 | .. | 1,660 | 1,827 | 5,699 | 7,360 | 1·3 | 20·9 |
| 19 | Bharam, .. | 450 | 510 | .. | 1,500 | 2,000 | 5,900 | 13,490 | 2·3 | 10·7 |
| *20 | Dhanan, .. | 557 | 321 | .. | 1,761 | 1,684 | 5,640 | 8,188 | 1·5 | 19·3 |
| †21 | Dissan, .. | 752 | 452 | .. | 684 | 1,623 | 5,817 | 8,249 | 1·6 | 13·9 |
| | Total and averages, | 12,805 | 9,162 | 289 | 13,516 | 21,090 | 90,916 | 1,26,263 | 1·4 | 16·7 |

* In these khats, there is closed Government forest.
† In these khats, there is no Government forest.

*N.B.*—A grazing unit is a sheep or a goat.
1 Buffalo = 5 sheep.
1 Bullock or cow = 2·5 sheep.

From the above figures the following may be deduced :—

| Khats with | Number of acres of waste land and open Government forest per grazing unit. | Number of grazing units per adult cultivator. |
|---|---|---|
| No Government forest, | 1·2 | not known. |
| Open „ „ only, | 1·3 | 12·5 |
| Open and closed Government forests, ... | 1·6 | 20·8 |

This points to the fact that, the grazing area where the great mass of the forests exists, is extensive compared to the number of cattle, sheep and goats accustomed to browse over it, and that no hardship has been inflicted on the people by closing portions for the purpose of reproduction, as their grazing grounds are still larger than those of the other khats. The grazing unit has been adopted from Mr. Whittall's calculations in the last Annual Forest Report for Oudh, and is based on the supposition that a buffalo eats 10 seers of fodder, a cow or bullock 5 seers, and a sheep or goat 2 seers per diem.

According to the present land settlement all the animals in the above list are entitled to free grazing in the open Government forests, but in reality only those villages nearest the forest graze their cows and bullocks in them, and a considerable proportion of the goats never leave the zamindári lands, although most of the sheep are brought to the high level grazing grounds in the forests from June to October. It seems, therefore, to point to a lack of appreciation of the importance of confining grazing in valuable Government forests to the actual requirements of the district, when privileges are granted to villagers, who do not require and never use them. Such an example almost suffices to show the importance of making a final enquiry into the interests of the inhabitants in these forests, and of definitely settling their privileges under the Forest Act.

Most of the forests included in the Deoban range lie to the north of Chakráta, and vary in altitude from 5,000 to 10,075 feet, whilst to the south of the station there are a few outlying bán oak forests. There are large areas of precipitous and rocky ground, especially at more or less southerly aspects, and the gradient usually varies between 30° and 45° and over, but gentler slopes of from 15° to 30° are occasionally met with. The gradients of the outlying oak forests vary from 15° to 45°. The principal types of forest are those of deodar, kail, fir, oak and chir.

To get a general idea of the effects of grazing on these forests, it will be useful to compare the number of III., IV. and V. class trees with those of the I. and II. classes, the two latter classes together representing unity.

| Kind of tree. | Forests closed to fires and grazing. | | | Forests closed to fires only. | | | Forests open to fires and grazing. | | |
|---|---|---|---|---|---|---|---|---|---|
| | *Diameter Classes.* | | | *Diameter Classes.* | | | *Diameter Classes.* | | |
| | V. 3″—6″ | IV. 6″—12″ | III. 12″—18″ | V. 3″—6″ | IV. 6″—12″ | III. 12″—18″ | V. 3″—6″ | IV. 6″—12″ | III. 12″—18″ |
| Deodar, .. | 7·5 | 4·0 | 0·9 | 4·2 | 1·8 | 0·7 | No forests open to fires and grazing. | | |
| Kail, .. | 20·2 | 4·8 | 1·1 | 8·2 | 2·5 | 1·0 | 1·0 | 1·0 | 0·9 |
| Chir, .. | No forests closed to grazing. | | | 6·5 | 2·0 | 0·7 | 0·4 | 0·7 | 0·6 |
| Firs, .. | 4·9 | 2·5 | 1·1 | 6·1 | 3·0 | 1·2 | No forests open to fires and grazing. | | |
| Bán oak, .. | 2·7 | 2·7 | 1·0 | 2·0 | 2·4 | 1·1 | 0·7 | 1·4 | 1·0 |
| Ayár & Buráns, | 12·0 | 10·0 | 1·8 | 8·7 | 9·1 | 2·0 | 10·9 | 11·9 | 3·2 |
| Kokat, .. | 39·6 | 15·6 | 2·2 | 29·0 | 12·4 | 2·6 | 19·1 | 11·7 | 2·8 |

Kail = *Pinus excelsa.*
Chir = „ *longifolia.*
Ayár = *Pieris ovalifolia.*
Buráns = *Rhododendron arboreum.*
Firs = *Abies Smithiana* and *Pindrow.*
Kokat = Miscellaneous species.

It will be observed that the forests open to fires and grazing are sadly deteriorating, since the number of V. class trees ought almost always greatly to exceed the number of I. and II. class ones, in irregular forests, such as we are here dealing with. The only exception is in the number of young ayár and buráns, but these almost worthless species, which never reach large dimensions, are always associated with bán oak, and it would seem as if, under the *régime* of fires and grazing, they were usurping the place of the valuable oak, whose reproduction is so backward.

In the forests closed to fires only, reproduction is not so good as in those closed to grazing as well, with the solitary exception of the firs. The reason for this exception is doubtless the fact that all the closed fir forests are at high altitudes and at cold aspects, where reproduction becomes difficult and seed years rare, whereas the open fir forests are lower down, many of them being below 8,500 feet.

The excellent remarks in the April Number of the "Indian Forester" on the irregular way in which the Berar forests are grazed apply with even greater force to those of Jaunsár. Here the cows and bullocks graze all the year round within a few miles of the village, as do also nearly all the goats, for the latter can stand being housed, and thus furnish valuable manure for the various grain crops. The sheep on the contrary are constantly on the move; all the sheep of one khat usually grazing together. They go down in the winter to the bottom of the valleys below the snow, and in the summer, are brought up to the high level pasture lands between 8,000 and 10,000 feet, where they remain from June to October, being taken back to the villages once for shearing purposes. Throughout the forests, there are regular halting places for these flocks, called 'taches.' They are open grassy blanks with gentle slopes, surrounded by small pillars of loose stones, on which the shepherds light fires at night to ward off wild animals.

There are, therefore, numerous congested grazing centres scattered throughout the open forests immediately around the 'taches,' and other heavily grazed areas, in close proximity to the villages, whilst elsewhere, there are considerable areas where the grazing is very slight or almost nil, the latter being the case on very precipitous ground, or on less steep slopes remote from water, or to which access is difficult. It has been observed that along a road leading to water, or to grazing grounds, the slopes above are often full of seedlings, whilst those below contain scarcely any, the explanation being that the flocks in going and coming do not climb up the steep banks, but almost invariably graze along the more accessible slopes below the path.

In the kail and deodar zone, reproduction is so vigorous that it is only near 'taches' and other heavily grazed places, or near the upper limit of the species that, we need fear for the future of the forest. In such localities, there are numerous grassy blanks, so closely cropped that, the grass forms a dense turf, reminding one of English downs. Here the scattered kail and deodar seedlings are much browsed down, remaining for years in the form of bushes, their branches spreading along the ground until perhaps the centre is beyond the reach of a goat, when a strong leading shoot is sent up. Over the more lightly grazed areas, reproduction is greatly checked, as is proved by the figures in the preceding pages, but the future of the forest is safe, although its potential yield is decidedly lessened.

There are no chir areas protected from grazing in the range, but the benefits of fire protection are more marked with chir, than with any other species, excepting perhaps kail, and the small chir area in the Raura block, which has been successfully fire-protected since 1872, is well worthy of a visit, and contrasts most favorably with the burnt forests which surround it. Now that the number of grazing animals to be admitted to the chir forests has been limited, it is hoped that, thanks to the wonderful reproductive powers of this pine, closing to fires alone will assure the maintenance of the forests, and that it will probably never be necessary to close the bulk of these forests to grazing, provided that fires can be kept out with the aid of the graziers themselves, although of course there will be small heavily grazed areas which may have to be closed for a time.

In the oak forests, we are confronted with an important question intimately connected with the grazing one, *viz.*, that of lopping the trees for fodder and for manure. However destructive indiscriminate grazing may be in a coniferous forest, it is still more dangerous amongst the oaks, for goats like nothing better than succulent oak leaves. The result is that, as regards the bán oak, reproduction is very backward in the open forests, and many of the young plants which do exist are misshapen and badly grown, and are frequently reduced to mere bushes by the persistent nibbling of the goats. Nearly all these bán oak forests are close to villages, and thus grazing goes on in them all the year round, whilst in the winter, the trees are excessively lopped for fodder, and the state of some of them in consequence leaves much to be desired. In the open part of Kurwa, where lopping has been continuously practised both for fodder and for manure, no trees were allowed to get above 15 feet high, and the area has been completely ruined. The

rules are, that no trees under 3 feet in girth are to be lopped, nor branches or twigs over one inch in diameter, and that the leading shoot is to be left intact, but the villagers have not observed these rules, and Kurwa is to be closed as a warning. They have been cautioned that if they persist in disobeying orders, the privilege will be withdrawn altogether. There are some similar rules for the third class forests, which are under the sole control of the civil authorities, but no attempt has apparently even been made to enforce them, and they remain a dead letter.

The present constitution of the forests as given below shows how they have suffered in the past from the combined effects of fire and grazing. The figures given are, however, subject to correction.

| Stocked with forest. | Plantations. | Blanks filling up with natural reproduction. | Blanks suitable for planting. | Unproductive areas. | Chaks of cultivation. | Total. |
|---|---|---|---|---|---|---|
| Acres. | Acres. | Acres. | Acres. | Acres. | Acres. | Acres. |
| 13,234 | 678 | 1,167 | 3,563 | 3,062 | 464 | 22,168 |

Thus when the forests were taken over by the Forest Department, nearly a fourth part of the ground perfectly suitable to good forest growth consisted of grassy blanks, and of this area, one-third, mostly in the closed forests, has been already covered with natural and artificial seedlings.

N. H.

RING-BARKING IN AUSTRALIA.

## RING-BARKING IN AUSTRALIA.

An interesting correspondence has taken place in the Melbourne "Argus" regarding the practice of *ring-barking* in Australia, which is extensively followed by graziers.

Dr. Andrew Ross, M. P., in New South Wales, considers ring-barking as a crime against the best interests of the Colony, and though he admits that grass vegetation becomes much more abundant after the trees have been ringed, yet he states that this grass is coarse, rank and indigestible, and deficient in chlorophyll and "*other nutritious elements.*"

The Melbourne "Argus" does not profess to know much about chlorophyll, nor about the laws of physiology and animal economy, but predicts ruin to the man who attempts to live by stock-keeping on 50,000 acres of ordinary unrung forest, while it is con-

fident that, fat sheep and fair clips are tolerably sure when once the trees are killed and the nutriment they might have absorbed is sent on to the grass.

It is a pity that the elements of vegetable physiology are not studied by Australian farmers and newspaper editors, and especially that the latter, who hold out the torch of knowledge in such a wealthy and populous city as Melbourne, should trust to their own natural shrewdness rather than to their scientific acquirements. After the outcry of Professor Huxley in the "Nineteenth Century," and of Mr. Goschen at Aberdeen, it is time for Anglo-Saxons all over the world to give up the system of learning truths merely by suffering from the disastrous consequences of neglecting them, and to endeavour to profit by the wide field of experience of others, which is now so richly offered by science, and in which Germany has taken such a decided lead.

But though the Editor of the Melbourne "Argus" may consider that the comparatively deep-rooted Australian trees deprive surface-feeding grass of its proper nutriment, and though Dr. Andrew Ross considers chlorophyll as the green juice of grass, which is much richer and more nutritious under the shade of trees, than in the open; both these gentlemen are actuated by the lofty desire to benefit their country, and their bold display of ignorance of the elementary truths of vegetable physiology in support of their opinions has a certain merit, as there is much to be said for the conclusions arrived at by both of them.

Dr. Andrew Ross's real contention is that, forests are essential for the well-being of a country, that, it is inhuman and cruel to condemn stock to live through blazing Australian summers on shadeless wastes, and that, forest destruction affects the rainfall and the discharge of rivers and the permanent timber supply of the country.

The Editor of the "Argus" entirely agrees with Dr. Ross on the necessity for the preservation of tracts of forest, such as those on the Otway ranges, which should act as a sponge for absorbing the abundant rainfall and the slow and continuous feeding of several valuable rivers, but he rightly considers that too much shade is prejudicial to grazing grounds, and argues for the destruction of stunted scattered box trees, and the clearing of land encumbered with them for grazing and agriculture.

Light is unquestionably essential for the formation of starch in the green parts of plants, and unless these contain plenty of starch, sugar and other nutritious compounds, grazing animals cannot be expected to thrive.

We should by all means allow small groves to remain here and there on grazing grounds, under which cattle can rest during the heat of the day, but the rest of the ground must be cleared of tree growth, if the grass is to be strong and really nutritious.

Of late, there have been attempts made by agricultural authorities in India to induce Government to open forest lands much more liberally to grazing, but in our opinion, grazing is best on cleared lands, and the maintenance of forests is incompatible with heavy grazing.

Grazing and forest lands should be gradually separated, and in forests intended to be maintained for the production of timber, the regulation of grazing should be left entirely to the Forest officer, whilst in grazing grounds, the sooner the tree growth, with the exception of what is required to shade cattle during the heat of the day, is cleared off, the better will be the grazing afforded.

The Melbourne "Argus" is clearly in favor of scientific forestry in Australia, as the following quotation shows :—

"There should be in each colony an educated forestry department, with competent local authority to enforce its decrees, and the permission of this department should always be obtained before any lessee of Crown lands is at liberty to begin on the wholesale destruction of the native timber. The necessity of planting on natural treeless plains, or in localities where an undesirable work of denudation has already been effected, is a matter which admits of no argument, and should have been tackled in practical fashion long ago."

Mr. Vincent of the Madras Forest Department lately wrote a report on the forests of Victoria, but the Minister of Lands has apparently not thought it advisable to publish this report, which we should be very glad to see. In a subsequent number of the "Argus" a champion of forestry has arisen, and his letter on the subject is so much to the point that we print it *in extenso*, and it is to be hoped that the Australian Statesmen will not sit down and talk about the benefits of forestry while their forests are disappearing, as they do in the United States and Canada, or start a Forest Department and then abolish it as an expensive luxury, as had just been done by the wiseacres who govern New Zealand.

"In a leading article in 'The Argus' of yesterday you quoted a statement by Dr. Andrew Ross on the effect produced on grass by the ringing of forest land. Dr. Ross is, I think, a little shaky in his vegetable physiology, or he would not refer to chlorophyll as a 'juice,' nor would he declare it to be 'so abundantly rich in all verdant grass and vegetation in an unrung country.' Chlorophyll is found in the form of granules,

and consists of two parts, *viz.*, the granule and a certain green colouring matter. The latter portion depends for its existence on the access of light, which has also the further effect of causing the chlorophyll granules to develop grains of starch. Arguing from these well-known facts, it appears to me that grass and other herbage which has grown under the shade of a forest is less likely to contain nutritious food than those plants which have developed under the more favourable conditions of light produced by ringing, and so killing, the trees above them. It is, however, I believe, universally acknowledged that forest growth has a beneficial effect on soil. The leaves, dead twigs, and fruits of forest trees falling on the ground year after year, and gradually decaying, form a soil or humus most valuable for vegetable growth; while the shade afforded by the leaf canopy keeps this soil cool and moist, prevents the destructive effects of sun-heat, and breaks the force of too heavy rain. The only reason why herbage does not thrive under a forest is simply insufficiency of light, and ringing the trees at once supplies this want.

"It would appear, then, that both theory and practice show ringing to be decidedly beneficial, if the object be simply to produce an increased growth of grass. But the further question as to the extent to which ringing should be carried on is a much wider one, and not quite so easily argued. Certainly nothing has yet been proved as to the way in which rainfall is affected by forests or by their removal. Nevertheless, dense forests and plentiful rains are usually found together, and the experience of the Cape Colony, where the disappearance of forests, owing to excessive felling, fires, and grazing, has been followed by severe droughts, is, at any rate, a significant fact, difficult to explain on any other hypothesis than that the trees were the cause, and the moisture the effect. As to the influence of woodland on the discharge of rivers, however, the evidence is much clearer, and, I may even say, conclusive. The disastrous consequences which followed the deforesting of the Alpes Maritimes, and the enormous expense in masonry, dams, and in works to again afforest the bare slopes, form an example of a striking character, which most readily occurs to one. I do not deny that this example is, perhaps, of rather a special nature, since the forests were situated on crumbling shale, which was really held up by little more than the roots of the trees growing on it, and as soon as these were removed the heavy rain, brought by the moist winds from the Mediterranean, rapidly produced torrents of terrific dimensions. But besides this other examples of less magnitude, though equally convincing, have frequently been quoted. I mean, for instance, such cases as streams having become so irregular in consequence of the removal of forests along their banks as to be useless for turning water-mills, where formerly the wheels were worked without inconvenience, while the mills again came into service when the forests had been allowed to grow up once more.

"It would be a most dangerous thing for public opinion in the colonies to consider that generally forest land is waste land; that all timber required can be easily imported—and of kinds far superior to indigenous sorts; and that the more timber cleared the better for agricultural and pastoral pursuits. There is yet time in Victoria to deal with this matter. Let competent experts decide what proportion of wooded to open country is necessary for the good of the community, and then let Government mark out forest reserves to that extent from the areas of crown lands still undisposed of. I am aware that a forest bill is to be presented to Parliament at the next session, and, until the provisions of this measure are known, it would be premature to discuss it. It seems to me, however, that the importance of Victorian forests is sadly underrated when the official who is to guide what should be a small State department is only to receive £650 per annum. The forest area of this colony is quite big enough and quite valuable enough to give ample work for one Conservator on at least £1,000, aided by three competent assistants on about £500 each. I am of opinion that the Government does not quite realise what a handsome return may be obtained financially from well-managed State forests, while at the same time ensuring the well-being and permanency of the latter. Should such proposals as these ever be carried out, where will the Victorian Government apply for competent officers? The science of forestry requires as much special knowledge and as much special training as any other profession, or employment of a technical nature. In Germany, in France, and in India, where are to be found the three greatest forest departments in the world, all superior officers, before obtaining their appointments, have to go through several years' training at special forest schools, while many of the subordinate officers have also to pass through a course of instruction in schools of less elevated standard. Why should not Victoria also send men to be trained for her superior appointments under the Conservator? The recently established courses of forestry at Cooper's hill would exactly suit the requirements of the case, and the expenses of travelling and maintenance ought not to be too much for the object to be attained. For minor appointments much elementary teaching of the most useful sort could be arranged at Dookie with very little extra expense. However the Government may now regard the matter, I have little doubt that the Conservator they may eventually appoint will, sooner or later, urge upon them the necessity of some such course as that I am now advocating. Fancy a man at the head of a magnificent charge obliged to leave the practical execution of his ideas to subordinates whom he knows to be untrained, unskilled, and worse still, perhaps filled with the bigoted ideas of ignorance—which is really the true term for many an uneducated man's 'practical experience.'—M. H. C.

*Melbourne, March 22nd.*

## RESIN PRODUCTION IN THE JAUNSAR FORESTS.

As already noticed in the "Indian Forester," trials for ascertaining the yield of resin were commenced in the years 1884-85 with 20 chir trees (*Pinus longifolia*) at Darmigád in the Bawar Range of the Jaunsar Forest Division, School Circle.

The spot is about 3,800 feet above the sea. The hill men's method was followed. Two cuts were made through the sapwood, and reservoirs were cut out in the wood itself for the accumulation of the resin. The following was the yield per tree :—

in the 1st year 3·6 seers or 7·4 lbs.
in the 2nd year 2·4 seers or 4·9 lbs.
in the 3rd year 2·2 seers or 4·5 lbs.

A mistake *occurred in the previous notice of this experiment in* the "Indian Forester" for March 1888. The pounds there given are really so many seers.

The trees show up to date no signs of decay, and tapping is continued.

The experiment has now been commenced on a larger scale. In the beginning of May trees were tapped as follows near Kathián in the Bawar Range, Jaunsar Division, School Circle :—

| Level above the sea. | Distance from Kathián. | Number of trees tapped. | *Species.* |
|---|---|---|---|
| 6,900 feet, | 2 miles | 500 | *Pinus excelsa.* |
| 5,700 ,, | 2 ,, | 900 | ,, *longifolia.* |
| 3,800 ,, | 4 ,, | 100 | ,, *longifolia.* |

The last place is in the valley called Darmigád, which meets the Tons river on the left. The aspect of all places is east.

The tapping was done in the following manner:—After removing the bark over a sufficient surface, an oval cutting was made into the sapwood about a foot from the ground, 10 inches high and 6 inches wide. At the upper end the cutting is 3 inches deep, and the depth gradually lessens from the top downwards, so that at the lower end it joins smoothly with the surface of the stem. This makes it easy to apply the curved chisel of 5 inches width of French pattern. It produces a slit, into which a bent plate of metal is inserted, so as to form a slightly inclined rim, over which the resin flows into a vessel which is hung externally to the tree. The vessels are conical, and hold one pound of liquid resin when full. Some of the vessels are of galvanized iron and some of burnt clay. The latter cost only one-fifth of the metal ones. After the clay vessels had been fixed to the trees there was no more breakage,

and they were as good as the metal ones. Only clay vessels will therefore be used in future.

As far as could be seen at the commencement of the tapping operation, the *Pinus excelsa* gave a far more valuable resin than the *Pinus longifolia*. The trees had, as a rule, two cuttings each, and some yielded half-a-pound in each vessel during the first 24 hours. The resin was as liquid as oil and very clear. The product of *Pinus longifolia* was much less liquid, only of the consistency of syrup. The yield of the *Pinus longifolia* was small at the commencement, but an improvement is expected in June, when the temperature will be higher. Both species showed very great difference in the yield of individual trees. Some trees yielded very well, whilst some produced next to nothing, without any apparent reason, except that in some cases of small yield the sapwood was thin. The trees were on an average of 2 feet diameter and more. The upper edges of the cuttings will from time to time be freshened up, and the cuttings thus gradually raised up the stem, the vessels following.

Samples of the two kinds of resin will be subjected to distillation to ascertain the proportion of dry resin, or colophony, and oil of turpentine. But it is expected that the *Pinus excelsa* resin will be utilized in the crude form for varnishes, &c. Some very liquid crude resin of *Pinus excelsa* was sent to Messrs. Gillanders, Arbuthnot and Co., Clive Street, Calcutta, for opinion as to its commercial value.

H. W.

---

## RECLAMATION OF USAR LAND IN BEHAR.

WITH reference to the extract from the annual report of the Agricultural Department, Bengal, for 1886-87, under the above heading in the "Forester" for March, it may be well to call the attention of your readers to the fact that it is not clear that the experiments described were performed on true 'usar' land at all. Certainly Mr. Marics is not reported to have said so in the extract given. Those of the readers of the "Forester" who do not know the nature of 'usar' land might be recommended to peruse the *Remarks on Saline Efflorescence on certain lands in Upper India*, by Lieut. J. F. Pogson, contained in Vol. III., N. S. of "Jour. Agri. Hort. Soc. of India," Part II., page 37, *et seq.*

The probability is that the land in Behar referred to is not 'usar' soil but 'reh' land, a very different matter; and this is worth bearing in mind, when there is any thought of reclaiming

saline soil. It is indeed not unusual, though it is incorrect, to speak of 'usar' soil as 'reh' land. This is generally, because of the human tendency to make the most of the matter in hand; the same tendency acting in the opposite direction in this instance makes 'reh' land be spoken of as 'usar.'

Mr. Maries' results are extremely interesting, more especially as all who know him will rely upon his facts. But it can only be by analysis after a lengthened period of cultivation that any conclusion can be come to as to the changes effected in the soil. If improvement does take place, the explanation may with some degree of safety be looked for in the physical conditions resulting from afforestation, not in any *wholesale** absorption of salts by the trees. It is easy for instance to see how, under such conditions, the efflorescent incrustation should disappear, and it ought to be no cause for surprise should a little difference be produced in the chemical nature of the soil after a long series of years. There can, however, be no question as to the advisability of cultivating the Rain tree in such districts. The amenity of the region will not fail to be increased, and the plentiful crop of sweet pulpy pods, greedily eaten by cattle, and ripening in April and May, when fodder is most scarce, which *Pithecolobium Saman* produces, will form an item of some value. At the same time it should be remembered that while the Rain tree is at home in Lower Bengal, and thrives well in Madras, the *précis* of the reports on its cultivation in Bombay, which is published in Vol. VII., N. S. of "Jour. Agri. Hort. Soc. of India, Part II., page 68, *et seq.*, is not altogether of a favorable tenor, and it has yet to be shown that the climate of Upper India will suit it.

D. P.

## COMPOUNDING FOREST OFFENCES.

THERE has recently been a good deal of correspondence in your columns concerning compounding forest offences, and much—if I may be allowed to express an opinion—unnecessary objection taken to the practice. As a matter of fact, any Forest officer in charge of a Division, in which much produce is removed by purchasers, will agree with me in feeling that, without the section of the Act in

* It is certainly true that some of the salts will be absorbed by the roots, and equally true that more salts will be absorbed by a rapidly growing species like *Pithecolobium Saman* than by more slowly growing species. But a wholesale absorption is not to be looked for, and all prediction should be suspended till exact analyses of the soil before and after cultivation are available.

question, the control of our forests would either be impossible, or, would cost such a fortune in establishment as to do away with any chance of a surplus revenue.

A little reading of the Forest Act, despite its somewhat ambiguous clauses, will soon put a Divisional officer into the way of settling petty cases without reference to a Magistrate, and of so recording enquiry as to secure a conviction when the offender refuses to compound and it is necessary to take the case into court.

The method followed by me is this. The original reporter of a forest offence is generally the guard in charge of a beat. He reports the matter to his Ranger on a printed abstract, sending one copy to the Magistrate of the circle (see further on for explanation of this action). In this abstract he gives the names and addresses of the offender and witnesses, nature of offence, &c. The Ranger then enquires into the offence, recording the witnesses' statements as well as that of the accused. Each statement is signed by the witness or offender, and if the latter chooses to give in a written admission of his offence, this is attested by two respectable witnesses, in whose presence the offender admitted his offence, and where the parties are unable to write, their marks are attested.

This report is sent to the Divisional officer who, going over the record, fixes the compensation he will accept, and returns the record through the Magistrate to whom the duplicate report was originally made, to the Ranger, who proceeds to demand the compensation.

This procedure does away as far as possible with any opportunity for extortion, for the enquiry must take place before two or more respectable persons not connected with the Department. A Divisional officer of any experience can almost always tell whether a case is an honest one or not, and a rigid adherence to the requirement from one's subordinates of clear and independent evidence to the offence will save the Divisional officer from giving improper orders. I have settled, literally, thousands of cases on this method, and have had to prosecute but a fractional percentage, while the refusals to compound, appeals against enquiries, &c., have been *very* few. Indeed my whole endeavour is, in these matters, to have the record so complete as to render any appeal to the Deputy Commissioner, as head of the Executive, or any objection on the part of the offender, of no avail. Another result of a little care in preparing the record is, that the proportion of convictions in those cases which are taken before a Magistrate is very high. This success is only obtained by the Divisional officer unmercifully

throwing out reports from his men, which are not completely supported by evidence.

With regard to the sending a copy of report of offence to the Magistrate, the question was raised by the then Commissioner of Jubbulpore some years ago. He pointed out that by Section 52 of the Forest Act every seizure must be reported to a Magistrate, but that, for the Magistrate to interfere in every case under Section 53, would be to render Section 67 of no use. He therefore directed that, a report should be made to the Magistrate (in our Provinces the Tahsildar), and the Magistrate would hold back any further action till the Divisional Forest officer had decided to demand compensation. By the Magistrate being made the means of communication with the Ranger, he is kept informed of the Divisional officer's action. The procedure meets the requirements of the Act, and at the same time, does not cause any unnecessary delay.

In your April Number, you say that the Divisional officer in the North-West Provinces himself enquires into every forest offence, but in the Central Provinces this would be impossible. In the first place, the Divisions are of such enormous size, and secondly, the forests are, as a rule, much intermixed with malguzari forest, which is the cause of the great number of petty offences, to enquire into which would take up the Divisional officer's time completely to the exclusion of every other kind of work. I fancy the forests in the North-West Provinces are more compact, for the Central Provinces Divisional officer would indeed rejoice in a state of things in which he had no more than a radius of 20 miles to go to reach the limits of his charge.

GORARH.

---

## COMPOUNDING FOREST OFFENCES.

AN explanation on the size of forest divisions and charges would probably have saved a good deal of correspondence that has lately taken place on the subject of "Compounding Forest Offences." The Editor in the April Number states that a radius of 20 miles from head-quarters is the usual size of a division "up-country," whereas in other parts of India, a distance of 60 to 70 miles north and south of head-quarters is not an uncommon case, *i.e.*, one has to march a direct distance of over 120 miles to get at the limits of the forests in his charge. If "Ghati" had to travel over a division of these dimensions, he would find that the settling

of forest cases in court—of course I mean as a rule trivial cases —a great waste and delay of time, not to mention the injury that might take place in forests that would be left unguarded pending the settlement of such cases in court.

Also there is another important point that should be kept in view when arguing this question, namely, the status of the forests. What heavy offences—excepting grazing—could take place in such waste land areas, *e.g.*, in Berár, as described by "E. P. D." in this April Number of the "Forester;" the thefts would chiefly be of grass, fuel, and fencing material.

*13th March, 1888.* A. J. C.

## DEHRA DUN FISHING ASSOCIATION.

The following is the text of the Memorial recently submitted to the Local Government:—

We the undersigned members of the Committee of Management, Dehra Dún Fishing Association, respectfully beg to invite the attention of His Honor the Lieutenant Governor and Chief Commissioner, to the necessity which exists for the preservation of Fish in the rivers and streams of these Provinces.

The initiative in this matter has been taken by the North Punjab Fishing Club, and a memorial was forwarded by them to the Punjab Government in June of last year. A copy of this memorial, together with the replies received, is herewith attached for information.

The points which the Dehra Dún Fishing Association humbly desire to bring to the notice of Government are—

*Firstly.*—That great local and general interest is taken in the preservation of fish, as evidenced by the fact that the Association, although formed only in June last, already numbers over 75 members residing in Northern India generally. The formation of the Association was brought to the notice of the late Lieutenant Governor, Sir Alfred Lyall, and a favorable reply was received from his Private Secretary; a copy of this is attached.

*Secondly.*—Within the last ten years fish have markedly decreased in both the large and small streams of these Provinces.

*Thirdly.*—That legislation is absolutely necessary, because there is at present no check whatever on the destruction of fish by means which in other countries are considered illegal and illegitimate. Netting is carried on night and day. Streams are turned and dammed with the inevitable result that not even can the small fry

officers who really feel and take an active and deep interest in the welfare of Natives.

*20th March, 1888.* JUSTICE.

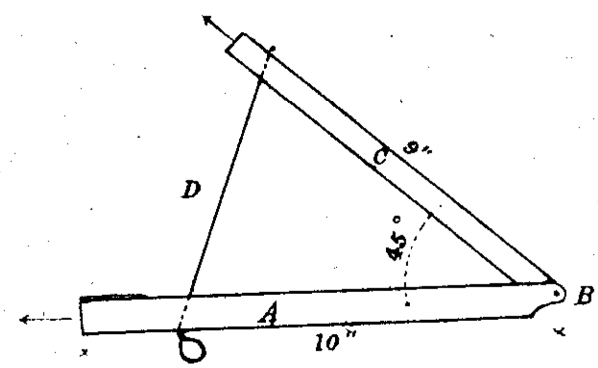
*Note.*—Our correspondent may assure himself that deserving men of all races in India are eligible for promotion to the grade of Sub-Assistant Conservator. A reference to the latest Classified Lists of Forest Officers gives the following :—

| | | | | |
|---|---|---|---|---|
| Bengal, .. .. .. | 1 | Native out of | 7 | appointments. |
| Assam, .. .. .. | 2 | " " | 3 | " |
| N.-W. Provinces and Oudh, .. | 3 | " " | 4 | " |
| Punjab, .. .. .. | 2 | " " | 3 | " |
| Central Provinces, .. .. | 5 | " " | 5 | " |
| Berár, .. .. .. | 3 | " " | 3 | " |
| Burma, .. .. .. | 2 | " " | 6 | " |
| Madras, .. .. .. | 3 | " " | 10 | " |
| Bombay, .. .. .. | 7 | " " | 13 | " |
| Total, .. | 28 | | 54 | |

[ED.]

## HEIGHT MEASURER.

I SEE Weisse's height measure figured on page 169 of the "Forester" for April, and as I have used for some years a somewhat simpler form, I enclose description of it and sketch.




A is a small bamboo tube with the upper side cut away, and attached by two small pins to another smaller one C at the joint B, so that the tube C can fold down *into* tube A. D is a non-elastic string knotted outside, as per sketch, and when open these tubes are at an angle of 45°. To measure a tree, peg the ring of a measuring tape in the stem at 3 or 4 feet up, and holding the tape and measurer in left hand, or with both, step slowly back holding A level, and when, looking through *both tubes,* the upper one is in

line with place to be measured, the tape then measures the exact height to that point.

S. E. PEAL.

---

ON the 30th of April about 5 P.M. a thunderstorm passed along the Siwalik hills, and in its course a flash of lightning struck a young green sál tree of some 18 inches girth, on one of the numerous summits of the range about 2 miles to the north of the Beribara rest-house in the Sahåranpur district.

This tree was at once in a blaze, and one of its branches falling on to the grass beneath, at this time of year as dry as tinder, set it on fire, which was at once carried by the wind into the surrounding jungle. In spite of the storm of rain the fire burnt over some 300 acres before it was finally extinguished.

There are about 12 feet of the trunk of the tree still standing, all charred and burnt, the fallen branch has been sent into the head-quarters of the Division at Dehra Dún.

L. M.

---

I AM credibly informed that a distinguished traveller observed in Southern Bengal a magnificent creeper or climber, I forget which, which he pronounces to be the mango in a form never observed by Anglo-Indians. Could this curious fact, if fact it be, have escaped our observation and only revealed itself to the trained powers of a scientific traveller, or could it have been a cucumber; which our eminent observer mistook for a mango?

The same authority tells the English farmer, that the increase in the export of wheat from India must soon cease, that in proportion as wheat culture in India extends, the pulse crops must be driven out of the fields, which are required for the more valuable grain crop, and that the natives, having no pulses to fall back upon, will soon be obliged to consume their own wheat. I believe we Anglo-Indians always were of opinion that few, if any, of the pulse crops occupied the fields at the time when wheat was grown.

I am startled, but perhaps some of your numerous readers are more confident as regards facts, and will kindly put me straight. I must, however, warn them before they are rash enough to contradict the traveller, that he is an eminent Professor on the eve of publishing for the information of the British public a book on the Agriculture and Forestry of India, and I only

A FORESTER.

## IV. Notes, Queries and Extracts.

THE FORESTRY SCHOOL AT COOPER'S HILL.—The Forestry School at Cooper's Hill is intended in the first place for the education of a certain number annually of young officers for the Indian Forest Department. The arrangements are, nevertheless, of such a kind that private students are admitted to the forestry course, in as far as space is available, and on condition that they conform to the rules.

It is in many ways advantageous that the Forestry School is attached to the Royal Indian Engineering College at Cooper's Hill. Although the course for forest students is necessarily different from that designed for engineering students, there are several subjects to be studied in common, and consequently the present arrangements admit of the forest students obtaining their training in surveying, descriptive engineering, and mathematics, for instance, in the excellent courses provided by the well-known Professors in the Engineering College.

The Forestry School itself consists of a block of buildings attached to the Royal Indian Engineering College, on the brow of Cooper's Hill, near Staines, and looking north over Runnymede and the Valley of the Thames. It is within a convenient distance from London, the traveller arriving at Egham (the nearest station on the London and South-Western Railway) in from forty-five to sixty minutes from Waterloo. Windsor Great Park is within a mile of the beautiful and spacious grounds in which the College stands, and the fine trees of all kinds to be met with in the neighbourhood give to the situation much that is desirable for a centre for the teaching of forest botany, and several parts can be made use of to a certain extent for illustrating subjects in forestry proper.

The building of the Forest School itself consists of large and small class-rooms, a museum, and the well-designed and appointed botanical laboratory. In this block the students pursue their main studies—botany, forestry, and entomology. Their other studies—engineering, surveying, mathematics, geometrical and freehand drawing, physics, geology, and one or two other subjects to be referred to presently—are pursued under the direction of the

various Professors in the class-rooms and laboratories of the Royal Indian Engineering College, to which the Forestry School is attached.

The forest museum is a convenient, well-lighted room, rapidly filling with useful collections of specimens illustrating the chief departments of forestry. Among the most valuable and conspicuous objects in this splendid collection may be mentioned the series of European and Indian timbers, which are so disposed that the student has ready access to them, while the Professors are able to refer to them in lecturing, and thus to make the teaching, in the best sense of the word, practical. Then there is a remarkably complete and interesting collection of implements used in forestry, and there are models of timber-slides, apparatus for catching timber, and other forest works, also so disposed that every student can handle and examine them and learn their uses with facility. Another valuable feature in this museum is the series of economic products of Indian plants. This is of course not complete, but the greatest credit is due to all concerned for bringing together for such useful purposes so many instructive specimens of fibres, seeds, barks, fruits, food-materials, &c., from the chief representative Indian plants; and when it is remembered that the Forestry School is so young, in this country (it was started in September 1885), it is the more praiseworthy that the authorities have made such good use of their opportunities and time. The collections must no doubt receive numerous additions as time passes, for it is well known that a museum takes many years to bring within measurable distance of completeness, but the Cooper's Hill museum is already fairly filled, the nucleus of the collections having been derived from the late Indo-Colonial Exhibition, and from the Royal Gardens, Kew. It would require too much space to enumerate the remaining interesting features of these instructive series of forest objects: specimens of timber showing the changes due to abnormal growths, the healing of wounds, the various injuries produced by unsuitable environment or by the attacks of insects and other living organisms, and last, but by no means least, a unique collection showing the ravages of those fungi which injure timber-trees, collected by Prof. Robert Hartig, of Munich, and presented to the School, and a collection of the more injurious forest insects, presented by Herr Oberforstrath Judeich, of Tharand. There is also a small herbarium, of a particularly interesting character, containing an excellent series of Conifers and other trees.

The botanical laboratory has just been completed, and is, without doubt, one of the best designed small laboratories, for its pur-

pose, that we have seen. It consists of an oblong room running east and west, and lighted from the north and east by windows arranged conveniently for work with the microscope. There are also tables and apparatus for experimental demonstrations in vegetable physiology; provision will exist for cultivating seedlings and plants at constant temperatures, for measuring growth, and for exhibiting the influence of light, gravitation, &c., on the growth of plants; and arrangements for showing the quantities of water given off from transpiring leaves, for developing plants in water-cultures, &c. The students are supplied with microscopes, re-agents, and accessories, and are taught to familiarize themselves thoroughly with all modern appliances bearing practically on their studies.

The above-mentioned block of buildings also includes one small and one larger lecture-room, which are provided with necessary teaching appliances. The series of botanical diagrams especially are remarkably good, and in fact many of them are unique, being the private property of the Professor of Botany, and drawn and coloured by himself. Another feature which must not be overlooked is the projected botanic garden. This will consist of a series of seed-beds, &c., illustrating the raising of forest trees, and of beds of plants chosen from the most important natural families, in order that the students may familiarize themselves on the spot with their chief characteristics. This botanic garden is now in process of being laid out, and it will be ready for the use of students in a short time.

The courses of studies followed by the forest students are admirably adapted to the wants of practical men whose lives will be largely spent in the creating, planting, preserving, and using of forest and other trees. Obviously, such a course must comprise several branches of teaching, the one thing common to all being that they bear upon the practical needs of the future forester. That the same training applies to a planter or estate-manager needs no remark, and portions of the course would be suited for others engaged in work in woodlands, and in the colonies, &c. The full course, as at present set forth in the syllabus of studies, is as follows:—

The student begins work in September, and attends lectures regularly during two academical years. In engineering, he is taught the principles of road-making, and the building of forest bridges and other structures; he is also instructed in the practice and theory of surveying under the care of the Professor of Surveying. In his first year he studies for two terms under the Instructor in

Geometrical Drawing, and in his second year receives lessons in the keeping of accounts. To these subjects may be added freehand drawing, and a modern language. In addition to these more technical subjects, the student attends certain short courses in mathematics and in applied mathematics, under the Professors of these sciences; he also studies physics—in lectures, as well as in the laboratory—entomology, and geology. A short course on organic chemistry is now being commenced.

The rest of his work consists in the special training as a forester, and it may safely be stated that there is no other centre in the Empire where so thorough and excellently designed a curriculum for a forester or planter can be obtained. The two subjects of forestry and botany are under the care of separate Professors. Dr. Schlich lectures on forestry, dividing his subject as follows:—In the first year he deals with the various soils, climates, and the regulating effects of forests on these; sylviculture, artificial and natural woods; the tending, thinning, pruning, &c.; the protection of forests against man and other animals, and especially insects, and against injurious plants, climatic influences, &c. During the second year the student is instructed in the utilization of forests; the technical qualities of woods; the felling, shaping, transportation, &c., of timber; the utilization of minor forest produce; the preservation of wood; saw-mills; charcoal, &c. He then passes to the study of working plans, and especially the arrangement of cuttings; surveying and mapping forests; measurement and determination of ages of trees and forests; and the methods of regulating the yield of forests. The final course of lectures is on forest law. In addition to the lectures, the students also make occasional excursions, under the direction of Dr. Schlich; the neighbourhood of Windsor Forest facilitating this important object, and enabling the Professor of Forestry to make his teaching thoroughly practical.

In botany, under the management of Prof. Marshall Ward, the students are instructed by means of lectures, and practical work in the laboratory and in the fields and woods of the neighbourhood. The course in botany is designed to train foresters, not technical botanists: its aim is throughout practical, and directed to teaching the students exact and thorough knowledge of the life-phenomena of the trees and plants which it will be their duty to rear, and take care of, and utilize in the future. Commencing with a short course of thoroughly practical instruction in the elementary biology of plants selected as illustrative types of the vegetable kingdom, the young student is taught the use of the

microscope and how to apply it practically in examining the tissues of plants. He is then instructed in the organography and anatomy of plants, learning (not only in lectures, but also in the laboratory and in the field) what the organs of plants *are*, and what they *do;* so that roots, stems, leaves, buds, bulbs, tubers, tendrils, thorns, &c., become to him not mere abstractions, but objects on which his attention will be continually fixed as active parts of plants. The study of cells and their contents, of epidermis and stomata, of vascular bundles and other tissues—of wood, bark, cambium, and so forth—is carried on thoroughly, not only that the forester may know the principles by which to classify and recognize timbers and forest products, and learn their uses, but also that he may understand what these various parts of the plants do in nature: how heart-wood is formed, how the timber grows and may be improved, how wounds may be healed over, how the roots take up substances from the soil, and how the plant makes use of them, and so forth. The student concludes his first year's study in botany (in the early summer) by familiarizing himself with the names and systematic position of the plants in the neighbouring fields and woods, especial attention being paid to the important trees and shrubs, and their relations to the forest flora of India.

During his second year, the student is instructed in the physiology of plants—how they feed, respire, and chemically change substances in their interior; how they grow, and are affected by light, gravitation, temperature, moisture, &c.; how they are reproduced, hybridized, and so on; the effects of various agents in the production of wood, in influencing the fertility, and so forth. The course is completed by the study of the diseases of plants, and especially of timbers, and how their effects may be minimized or healed.

As special features of the greatest importance, it should be mentioned that the senior students pay periodic visits to the magnificent gardens, museums, and plant-houses at Kew, under the direction of Prof. Marshall Ward, in order that their knowledge of the important economic plants and their products shall be real. They see the plants growing, learn to familiarize themselves with their peculiarities and habits and uses, and are thus not strangers to them when they land in India. Secondly, the young foresters are taken abroad, and taught what life in the forest really is. At the completion of their first year's studies, they accompany the Professor of Forestry to Scotland, or to the New Forest, or to the Forest of Dean, as may be decided for the year; and at the end of their second year they are taken to the Continent for three or four months' practical work in Germany and France, to examine the

systems pursued in the large and more systematically managed forests of those countries, and thus to study the art of forestry in practice under conditions more resembling those met with in the huge and valuable forests of India.

During the summer of 1887, for instance, the young officers who are now in India were taken to Bavaria, under the direction of Dr. Schlich, accompanied by Prof. Marshall Ward and Mr. Gamble. They visited the magnificent museum and laboratories of the Forestry School at Munich, the Forest of Freising, the willow nurseries and plantations at Oberberghausen, the spruce forests at Hohenaschau, and the timber depôt at Traunstein. They then proceeded to the Austrian forests of the Salzkammergut ; and later to the Forest School and school forests at Nancy, the cork oaks and pine forests in the Esterel, and the *Pinus maritima* forests on the west coast of France, used for the preparation of turpentine as well as for timber.

With this practical tour, the training of the young forester in Europe stops, and he departs for India to assume the new duties and large responsibilities of his life as a forest officer under the Imperial Government.—*Nature.*

---

THE FURTHER DEVELOPMENT OF THE TEAK TRADE.—Just as the exigencies of Good Friday had compelled us to complete our *Journal* for last week two days earlier than usual, a piece of news came to us by telegram from the East, which appeared to us of great interest to the British commercial world at large, and to the timber and shipping trades of this country in particular.

The intelligence we received was the report of a dinner which took place at Singapore on Tuesday, the 27th ultimo, at which General Sir Andrew Clarke, the guest of honour, informed his audience that the mission he had undertaken to Siam, in order to obtain a concession for the proposed railway from Bangkok nearly to the borders of Southern China, had been entirely successful, so that the line, which would go as far as Zimme, an important town near the northern frontier of Siam, will offer to the outside world of navigation the shortest available route to that part of the Chinese Empire which is now the least accessible to Europeans.

This portion of that vast empire is said to be occupied by an industrious and thrifty people, who will be glad to exchange commodities with us, and with whom there is every prospect of a large trade being opened. In *Hazell's Annual Cyclopædia* for last year will be found a good account of the projected railways in our vast

Eastern possessions, from Southern Burma, including Moulmein, to Esmok, on the borders of China.

Messrs. Colquhoun and Hallett, the eminent engineers, who have surveyed the country and got railways already at work there, have also published the result of their surveys in a well-arranged and carefully compiled book with cuts and maps describing the entire country which the route traverses, to which we shall take an early opportunity of again referring.

These railways would run partly in British and partly through Siamese territory; the Government of the latter kingdom had, therefore, to be propitiated before this scheme could be carried out, and the necessary pre-arrangements appear now to have been brought to a successful issue.

It was one of the stipulations of the Siamese Government that a railway should be constructed from Moulmein to Raheng, in connection with the line from Bangkok to the northern border of Siam, and if that be agreed the British export trade to those regions will eventually go chiefly through Moulmein, which will then be the great emporium for goods and passengers from Europe to China and save the navigation of the Straits of Malacca and the long coast line of the Gulf of Siam at the back of them.

The countries through which these railways will run are thus described:—

"On the Chinese borders near the points touched by these railways are a range of provinces with an aggregate of 38,000,000 of people who have not a railway amongst them; then there are the teeming millions of Burma and the rich country of Siam."

This is such a new opening for a great future trade that it will be like the intertrading of another India, and all these populations and principalities appear to favour British adventure. The King of Siam (an absolute monarch, with decidedly progressive tendencies), whose son was educated at Oxford, shows his appreciation of us by appointing British commanders to the sixteen steamships which constitute the Siamese navy.

The subject was well treated in the "Morning Post" of the 29th ultimo, from which, with reference to the teak trade, we make the following extract:—

"The central point would be Raheng, a city which, owing to many natural advantages, may be counted the most prosperous place, even under the present *régime*, in the whole kingdom. Its situation marks it out for future expansion, and it is destined to become an important distributing centre for both raw produce and manufactured goods. Its timber trade alone would suffice to en-

sure the success of a railway running up to the capital. Enormous quantities of 'teak' and 'sapan' are floated down the river, on which Raheng stands, every season. Unfortunately, the river can only be used for a short period every year, when there is sufficient volume of water in the bed to float the logs, so that it not unfrequently happens that the stores of wood lie by in creeks and shallows for weeks at a time, to the consequent loss of the dealers. Often whole rafts are destroyed by the fires which are only too common. All that is really wanted there is a means of transport such as could be depended upon at all seasons of the year to carry down the freights of wood, horns, skins, and beeswax gathered at Raheng from the country around, to the markets of Bangkok, whence it could rapidly be distributed by the shippers ever ready to receive it. Such a means of transport can only be furnished by the railway now to be constructed, which will take to Northern Siam the cotton, calico, and Birmingham goods so largely in demand there."

As the railway will run through territories abounding in teak forests, it is not improbable that the trade in that valuable timber will be at least quadrupled at Bangkok shortly after the completion of the undertaking.

Great trunk railways of 500 miles and upwards, however, are not constructed in a year; and if the wood is to be cheapened, which is all it requires to give it an important lead in every European market, it will be a very gradual process which need not disturb any existing engagements. But the trade will not have to wait the completion of the entire railway, as the opening of every fresh station while the work is proceeding will bring a great increase of trade to Bangkok; and as it is stated that teak and sapan would of themselves keep the railway going, we can judge of the great importance its timber trade is to the people of Siam. In the meantime, the connection between Upper and Lower Burma will still further add to the supplies of teak at Rangoon, and British shipping as well as its various export trades cannot fail to receive a new impulse from these steam roads to new and far-off lands hitherto scarcely brought within the boundaries of our commercial arrangements.

While our timber trade with America is decreasing, there is every prospect of that with our vast Eastern possessions, and their contiguous territories, largely developing, and it only wants the wood to cheapen for the consumption of teak henceforward to be greatly on the increase. Already it is becoming a favourite with ship-builders, coach-makers, cabinet and other trades, and will

easily supplant many other descriptions of timber directly the price comes nearer to those that are now used entirely on account of the difference in cost.

Before concluding our remarks, a few words on Bangkok itself may not be out of place, especially now that it is likely to play such an important part in the future history of the teak trade as well as in British commerce generally. It is the capital city as well as seaport of Siam, and has been, not inaptly, called the Venice of the East, because it consists of houses built in the sea on piles 10 feet high to avoid inundations, and, like the "city of song" just mentioned, every house has its gondola or boat. It is situated on an island formed by the River Menan, and lies 40 miles south of the Siamese boundary line. Its population is, according to Whittaker, 255,000, but another authority puts it at 400,000, which is probably the more correct. The country round about is very fruitful, and the interior is covered with vast forests, yielding teak, sapan, and other valuable woods; it is right through the centre of these that the projected railway will be constructed, not only further developing the trade with timber in the neighbourhood, but putting it in direct connection with Moulmein and Rangoon, and the timber from those districts lying between.

The harbour has a sand bank or reef, consequently only shallow vessels can come to the quays, and all the timber and other commodities to big ships have to be loaded outside the bar. However, in those regions this is not of much consequence, labour being always abundant and cheap, but if it were found any hindrance as the trade of the port further developed, capital would soon be forthcoming to overcome any obstacles in the way of rapid trade.

Bangkok stretches over a very extensive area and already is a large and busy town, and when put into direct and rapid communication with other thriving centres by the new railway, promises to become an important *entrepot* for British commerce.—*Timber Trades Journal.*

---

THE MOST EFFICIENT MEANS FOR PRESERVING WOOD.—A simple and cheap composition, easily applicable and thoroughly reliable as a preservative for wood, which during 11 years has stood the severest tests, and also for a considerable time found application in trans-atlantic parts of the world, has by reason of its eminent properties everywhere met with undivided attention, and may therefore now claim general recognition.

This important invention, commercially known under the name

of Carbolineum Avenarius, is an antiseptic (disinfecting) oil for impregnating and coating wood, and protects by its preserving and disinfecting properties all kinds of wood from decay, fungus and rot, keeping off, at the same time, its numerous enemies, such as insects and vermin of all sorts. It surpasses, in efficacy, all other remedies used hitherto, such as paint, tar, &c., &c., no less than the various nostrums recommended against the formation of fungus, being cheaper and by far more reliable than any other substances. Carbolineum Avenarius stands pre-eminent not only as the great preserver of wood, but also of stone (nitrous exudations) for damp walls, for the conservation of ship tackle, and other purposes as may be seen from the various testimonials. The application of this antiseptic oil is most simple, and may be performed by anyone, either by means of an iron-bound brush or by dipping the wood into the fluid, and the impregnation will be all the more effective if the oil has been made warm previously. One of the characteristics and essential advantages of Carbolineum Avenarius is its ready penetration into the wood, whilst all substances previously employed only covered the surface, closed up the pores, and consequently accelerated the decay of the wood whenever the same was not sufficiently dry. Carbolineum Avenarius is neither liable to inflammation, nor does it contain poisonous ingredients; applied either on dry or on green wood, it will give the appearance of stained wood with transparent veins of a nut-brown hue. It may be stored in the original barrels, or in any other suitable vessel for an indefinite time, if efficiently protected, without the least risk of deterioration. One pound of Carbolineum Avenarius will cover a surface of about 3 square yards at less expense than any other material and at only one-sixth of the cost of adequate coatings with oil paint which it far surpasses by the permanency of its action, whilst, even as compared with tar, it maintains its superiority, being less stiff and more capable of penetration than this latter, therefore more effective and economical at the same time.

The Directors of the Palatine Railways have given the following testimonials :—"Two boards cut from one and the same piece of pine and of which for the sake of experiment, one was painted with Carbolineum and the other left unpainted, were buried in the ground, and after a lapse of three years examined. The result was that the wood on which the Carbolineum had been applied showed no signs of decay, whilst the other was found to be in a rotting condition." The General-Administration of the Independent Congo State, Department of the Interior at Brussels, reports

under date of December 4th, 1886, signed. Strauch, as follows :—"Carbolineum Avenarius keeps white-ants and other insects from piercing the wood for the purpose of depositing their eggs, and thus prevents its destruction. We also find that wood well impregnated with this liquid is better able to withstand the influence of damp air. We therefore recommend the use of Carbolineum Avenarius for all Government buildings, especially for those parts of the houses which come in contact with the ground." The Basle Missionary Trading Company received from their factory at Mangalore the following report written in October 1886 :—"The trial we made with Carbolineum Avenarius has been a success inasmuch as a log of wood which we had brushed over, once only with this fluid, was found intact, after having remained buried in the ground from November 24th, 1885, to June 22nd, 1886, whilst of a similar log buried from the middle of February to June 22nd, and not treated with Carbolineum Avenarius, half its substance was found destroyed by the action of white-ants."

Wherever the Carbolineum Avenarius has been introduced, it gained universal approval within a very short time, and is now used on railways: waggons, cars, telegraph poles, sheds, fences, and other wooden structures; ship-building yards and harbour structures: vessels; boats, cordage and ships' tackle, locks, wooden bridges and all kinds of wainscoting; building and mining trades: for all wooden parts above and below ground; farmers' and gardeners' implements, such as vans, carts, ploughs, water-casks, trunks, posts, piles, poles, &c., &c. The Carbolineum Avenarius is now in almost universal use, and has everywhere met with the most flattering recognition by public bodies, and by the industrial and farming interest, as proved by numerous testimonials from Government and municipal authorities, railway directors and architects, many of such certificates being founded on ten years' trials which triumphantly exclude the last doubt in the mind of every impartial observer as to the sterling and unsurpassed properties of the Carbolineum Avenarius, which is now supplied from three factories in daily increasing quantities. All further enquiries to be addressed to Mr. Paul Lechler, Stuttgart (Germany).—*Indian Agriculturist.*

---

Mahogany Experiments in Southern India.—The experimental cultivation of this importiant timber tree continues to receive particular attention in the Madras Presidency. From a report by Mr. J. S. Gamble, Conservator of Forests, Northern Circle, on experiments carried out last year within his jurisdiction, we gather

that altogether 85½ lbs. of seeds were received by him from various sources, which were distributed in the districts of Ganjam, Kistna, Nellore, Cuddapah, and the Nilgiris, between the months of August 1885 and January 1887. In addition to the above, 1,200 plants in baskets were sent by the Director of Agriculture in October 1886, which were distributed between Cuddapah and Nellore. Full reports have been received from all districts except Ganjam.

In the Kistna district, of the plants raised from seed, some 1,500 were planted out at distances of 36′ × 36′ in the Weld plantation at Masulipatam, which covers an area of about 80 acres. The soil is described as sandy, containing a varying proportion of clay and slight traces of salt. The seedlings have thriven very well here, and now vary from 2 to 4 feet in height. In addition to the above, there are about 3,780 plants in pots in the nursery, which the Collector intends to plant out during the present rainy season. Other species of trees (among them *Terminalia Arjuna* and *Cedrela Toona*) have also been planted out with the mahogany, and the two named are doing very well. This plantation may be considered one of the successful ones.

In Nellore the results were not very satisfactory. Of 300 plants raised from seed, 112 died, and the remainder were planted out in the jungle. These have not grown well, though they are described as still healthy and strong. Of the 700 plants sent in October 1886, 468 were alive in January 1887. Out of a second batch of 10 lbs. of seed sent to the Collector in September 1886, only 562 plants were raised, of which 25 died. The reason why so few plants were raised from seed is, that it was sown in sand instead of in good soil, and also because the Collector thinks it was received too late in the season.

The most satisfactory results were obtained on the Nilgiris. No less than 13,300 plants were raised from two consignments of seeds in August and October 1885, and planted out in the June and November following, at an average distance of 22′ × 23′. There were only 63 casualties, the rest being in flourishing condition, especially those in the bed of the stream. The height of these seedlings varies from 18 inches to 4½ feet, while that of those on higher ground varies from 12 to 18 inches. In September 1886 a further consignment of 10 lbs. of seed was received by the Collector of Nilgiris, which was sown at once, and gave 5,000 plants, out of 11,145 seeds, the sixth day after sowing, the rest of the seeds not having sprouted even. This goes to show that more than 50 per cent. of the seed was bad. No casualties have occurred among

these, and they are reported as being from 5 to 6 inches in height, and healthy. The Collector notes that a moist locality appears to suit the plants better than dry places, and this hint might be utilized to advantage in further experiments. Mr. Gamble considers this plantation a decided success. It covers 100 acres, and a further note upon it is under preparation. We entirely concur with Mr. Gamble in the opinion expressed by him, that "the experimental cultivation of mahogany had better perhaps in the future be confind to Sriharikot and the lower forests of the Nilgiris. It is of no use to make small plantations in a case like this; the only way to really prove that mahogany can be properly grown, and to produce some result commensurate with the expenditure, is the work on a sufficiently large area."

*In the Cuddapah district there are two plantations,* and the district forest officer has submitted a somewhat full report upon them, which we have reproduced *in extenso* elsewhere, as it contains some interesting features.

Taken as a whole, it must be admitted that the experimental cultivation of mahogany in Southern India has been attended with hopeful results. There is no reason why this tree, the wood of which is so much valued by cabinet makers, should not become naturalized in this country. If the trees now being raised can be *induced to produce fertile seed, it ought not to be such a difficult* matter to naturalize it. There are, if we recollect rightly, some really fine specimen trees in the Royal Botanical Gardens, Seebpore. There is one tree in particular which struck us as one of the finest we have seen, it must be fully 80 feet high, with a girth of about 12 feet, approximately.—*Indian Agriculturist.*

---

THE GROWTH OF RAIN DROPS.—When several rain gauges are set up in the same locality, but at different heights, a curious fact usually presents itself. The quantity of rain that is falling on a given surface is shown to diminish with the height. This, according to ordinary notions of the supply of rain from the clouds, appears very paradoxical. Some meteorologists even question the accuracy of the rain gauge record. Thus Professor Cleveland Abbe attributes the difference to the action of the stronger winds to which the rain gauge is exposed when set high up. These, he suggests, carry the drops to one side, so that the higher gauge catches less than the lower one. I do not see how that accounts for the obsered facts, but they are easily explained if we reflect a little on the ordinary physical conditions of rainfall. I say the "ordinary" conditions, not the exceptional conditions. One of these ordinary conditions is that the air through which the drops of rain fall is

fully saturated or even supersaturated with aqueous vapour; and another is that the temperature above is lower than that below, and therefore the drops of rain coming from above are cooler than the air through which they are falling. This being the case, each drop acts as a condenser to the vapour through which it is passing, and thus grows in size as it descends. This increase of the size of the drops has been well observed, and is not at all covered by Professor Abbe's explanation. The following is an experience of my own. I started on a "soft day" to ascend Ben Nevis. Rain was falling at Fort William. At about half way up the mountain there was a mixture of rain and sleet. Gradually the proportion of snow flakes increased, and finally before reaching the summit, dry snow was falling. I have passed through the same series on other occasions. It would be the common experience of tourists, but for the fact that we rarely start to climb a mountain in wet weather. The characteristic "nimbus" or rain cloud is a cumulus or rounded cloud extending downwards in shapeless mass, cloud above, mist below. The whole cloud is supersaturated stratum of atmosphere in the condition of condensation and precipitation, the rounded upper surface indicating the upper boundary of this condition. Rain is produced throughout this cumulo-stratus cloud at all elevations from its woolly summit down to its base, which very commonly rests on the earth's surface. There are occasions when rain drops diminish as they fall. This must of necessity occur whenever the rain is formed above a dry stratum. In such case the falling drops must rapidly evaporate. The north side of the Romsdal (Norway) is a magnificent wall of dark-coloured rock, ranging at the lower part of the valley from 2,000 to 3,000 feet in height. Over this are poured a multitude of cascades, some of them mere threads of water. On a clear summer's day the continuous sunshine warms the dark rock so effectively that some of these minor falls, after breaking as they all do into snow-like spray, vanish altogether by evaporation. I witnessed this on both of my visits to this valley on hot days of different summers.—W. Mattieu Williams, *in the "Gentleman's Magazine."*

---

We read in "Nature" that the Government of Ceylon has sanctioned the opening of a Forest School at Kandy, and we wish it every success.

---

THE

# INDIAN FORESTER.

Vol. XIV.] July, 1888. [No. 7.

## THE FORESTS OF MANIPUR.

*By* GEORGE WATT, M.D., F.L.S., C.I.E.,

*Reporter on Economic Products with Government of India.*

*Position and Physical Features of Manipur.*—From the Bay of Bengal, near Chittagong, a closely-packed belt of mountain country rises from the plains of Bengal, Cachar and Assam on the one side, and from Burma on the other. This wall extends through the so-called Chittagong Hill tracts to Manipur and onwards north-east to the Naga Hills, until it terminates in the Patkoi Hills and the Bhutan Himalaya. Manipur is thus the middle portion of this highland country, and lies within Lat. 24° 13′ and 25° N. and Long. 93° 10′ and 94° 50′ E. It is traversed by a bewildering series of approximately parallel ranges which trend S. W., and are every now and then knotted together by transverse spurs in the vicinity of the culminating peaks. Within these ranges a number of valleys are hid, the largest and most southern being the valley of Manipur proper. This is inhabited by the race of people known as the Manipurís (or Meitheis as they call themselves), while the surrounding hill tracts are peopled by various races of Nagas, and recently by certain invading Kukies or Lushais. These Nagas and Kukies speak some twenty entirely different languages—a fact which may be accepted as indicating the ancient subdivision of the State into small isolated tracts of country inhabited by antagonistic races. The total area of the territory is about 8,000 square miles—the valley proper comprising only some 650 square miles. The entire population of the State has been returned at 139,000, of whom 65,000 are Manipurís. It has been estimated that out of the total area of the valley proper only about 200 square miles are cultivated, while 400 square miles of rich soil, of almost perfectly

2 P

level land, having a mean altitude of 2,570 feet above the sea, remain to be brought under cultivation, together with an amount of hilly culturable land of which no calculation has yet been made. The Nagas, like all other hill tribes, cultivate the slopes of the hills —terracing laboriously the land near their villages. They seem to have been driven to the crests of the hills through persecution, since evidences exist everywhere of a former more extensive cultivation on the lower slopes and valleys—parts of the State now almost entirely covered with rich grass and inhabited by wild animals. One cannot think of a more favourable region for tea cultivation. Miles upon miles of rich land, superior to anything found in Cachar or Assam, exist everywhere in this lovely country, while, in justification of this opinion, it may be added that forests of wild indigenous tea are to be seen throughout the eastern and north-eastern divisions of the State. Within the valley numerous low red clay hills exist that were once covered with pine (*Pinus khasiana*) and other trees, but these by a slovenly and destructive policy have all been removed and not replaced. The hills further up are thickly wooded, but the migratory Nagas and Kukies are annually effecting terrible havoc on the forests, the jhuming system of cultivation being everywhere permitted. Trees that have taken perhaps a hundred years to grow are ruthlessly hewn down and burned, in order to clear small plots of ground which are cultivated for one or at most two years and then deserted. Forest fires occur annually, and even the valleys are periodically burned, thereby utterly destroying all chances of natural reforestation.

But to convey an impression of Manipur sufficient to afford a key to its interesting flora, we must endeavour to give a more perfect idea of its mountain and river systems. About four days' march to the north of the capital, the frontier bordering on the Naga Hills is reached. All along this journey the parallel hills, to which I have alluded, are seen to ascend higher and higher towards the transverse ridge which forms the frontier and great water-shed between Manipur and the Naga Hills. The rivers on the western side of Manipur finally escape into Cachar, those that traverse the Naga Hills into Upper Assam.

The Khasia and Garo Hills of Assam springing up from the banks of the Brahmaputra stretch east, through the ranges known as the northern Cachar Hills into Manipur and the Naga Hills, abutting at the great transverse water-shed which is extended still further east into Burma, until it terminates in the lofty peak of Sarameti, 12,600 feet in altitude. The Assam arm of this transverse mountain system thus separates Upper Assam from Cachar, and com-

pletes the isolation of the waters of the Indo-Burman region. But this curious bifurcation of the mountains of Eastern India (south of the Himalayas), exercises also a great restricting influence over the vegetation at the same time that it largely controls the rainfall. To understand this, we have but to recollect that the rainfall on the southern face of the Khasia Hills at Cherrapunjí is 474 inches annually, while a few miles off at Shillong it is only 84·8 inches. Throughout Manipur a similar erratic distribution occurs, being at one place but a third of what it is at another only 17 miles distant. Passing east along this wall—(a wall to the south, but practically parallel to the Himalayas, and transverse to the series of ranges which extend to Chittagong)—evidences exist everywhere of the influence of the great triangles formed by the mountains which throw the waters south through Manipur, south-west through Cachar, and north through the Naga Hills, into Assam. The moisture-laden clouds from the Bay of Bengal pick up more and more water as they pass over the rivers and marshes of Eastern Bengal, only to dash their torrents against this transverse wall which intercepts the clouds on their way to the Himalayas. But on advancing north the clouds are caught up in the numerous parallel valleys, and are thrown this way and that, and so broken up that the rainfall in one locality, often not more than half a mile from another, may be quite different. These local modifications of rainfall have their exact counterparts in the forests, the greatest possible contrast occurring on the two sides of a peak or spur. The average annual rainfall of the valley of Manipur proper is perhaps about 49 inches, but it is much greater on the hills.

The mountain ranges on the eastern side of Manipur and the Naga Hills are so compact, that the rivers have to struggle for a long time before they can find their way into Burma. A few streams do, however, artificially cut their way through these ranges ; and thus Manipur is ultimately drained west into the Barak—the river of Cachar—and east into the Ningthi or Upper Kyend-wen, one of the head streams of the Irrawadi. The great transverse range or watershed which divides Manipur from the Naga Hills is not, however, the only connecting link between the Manipur parallel mountain ranges. I have already remarked that these ranges are knotted together by spurs from the culminating peaks. These cause the rivers that have been flowing south or south-west to be deflected back to flow for the same distance north-east, only to meet other spurs round which they escape to resume their south-westerly direction. One may stand on a ridge and admire the glistening silvery streams on either side so near, that in fancy a stone might be dropped into

their eddying pools; and yet these waters are one and the same flowing in opposite directions. This picture is repeated time after time, each day's march bringing the traveller to the shoulder of a hill where he stands amazed and puzzled as to his own position. No country could be more troublesome to the explorer, and it requires the most careful observation to preserve a record of the day's wanderings. The river basins, usually so convenient a mode of preserving such a record, are altogether misleading. In one day two or three rivers may be crossed, one flowing north and the other south. I may illustrate this fact by tracing the course of the upper stream of the Barak. This wanders up and down through the series of parallel ranges which form the western wall of Manipur before it finds its outlet into the plains of Cachar. In following its meanderings we shall obtain a conception of the western mountain ranges; and as these are densely clad with forests of a kind altogether distinct from those found on the eastern side of Manipur, it would in any case become necessary to devote some time to the study of these hills. The writer, in a paper read before the Anthropological Society of Great Britain, has described the scenery and rivers of the western wall of Manipur thus :—"The road from Cachar to Manipur passes over nine nearly parallel ranges, and these constitute the western wall of the valley. This road is carried by giddy cane suspension bridges across the deep and blue rivers which flow between the hills. These bridges are in many respects unlike the platted bark bridges of the Himalaya, being stronger and more durable. A long cane (the scandent stem of the palm, *Calamus Rotang*) 300 or 400 feet long, is carefully selected and drawn across the river. This, stretched at each end over a natural rock, or a masonry or wooden pillar, constructed for the purpose, is fastened by beams driven into the ground beyond the pillar. A second or even a third cane is similarly stretched across, and the belt formed by these canes is thereafter platted into a pathway of about a foot in breadth. The pillars are then carried to a further height of 6 feet, and two other strong canes are stretched across from the top of these pillars and about 3 feet apart; these are fastened by more distant beams into the ground. A small doorway is left in the upper portions of the pillars leading to the pathway. By means of a carefully selected set of canes cut so as to leave at one extremity a V-shaped stump of a branch, the upper suspension canes are bound to the pathway by the V-shaped end being hooked on to one of the upper canes and carried below the pathway and tied to the opposite upper cane. The next one is hooked on to the opposite cane, then carried under the pathway and tied to the

other suspension. In this way the suspension canes are securely bound throughout the entire length of the bridge to the pathway, and while with the weight of the passenger the bridge curves and sways to an alarming degree, it is impossible to fall off the tunnel-like structure through which the traveller has to pass. Some of these bridges providing for the great rise in the rivers during the rains, are carried as much as 50 feet above the ordinary level of the water, and while a giddy sensation is caused by the water being seen to flow beneath the feet—a sensation as if running violently up the stream sideways—still at all seasons of the year, the rivers of Manipur may be crossed in safety."

"To illustrate more forcibly the deep gorges which cut up the mountainous tracts of Manipur, it may be here added that on the road from Cachar to Manipur the following large rivers are crossed :—The Jírí, the Makru, the Barak, the Irang, the Lengba, and the Limatak, in a journey of only about 80 miles. So deep are the gorges in which these rivers flow to the south, that in most of them the sun sets on the rivers some hours before its golden tints have faded away from the forest-clad summits of the hills which cast their gloomy shadows on the deep and still waters. Nothing could more forcibly depict the configuration of Manipur than a history of its rivers and their contortions before they are permitted to escape to the plains below. The Barak, the largest and most important river of the country, for example, rises N. E. of the Makru and Irang rivers, and flowing S. W. then N. E. and turning W. N. W., it resumes again its S. W. course, thus sweeping round the head streams of the Irang and Makru. Again flowing S. E. it receives in its course in addition to the Makru several small streams ; next the Irang ; still pursuing a southerly course, it receives the Tepai, which flows north from the Lushai country to join it ; at this point it makes a sharp bend and flows nearly due north until it receives the waters of the Jírí ; after which it enters British territory and flows west through Cachar. This is a brief history of the river system within the western wall of Manipur, a wall in which the Barail constitutes the most lofty range. An illustration of this kind shows how closely the mountain tracts of Manipur are packed with parallel ranges of hills and deep gorges."

This western wall terminates on the great water-shed, having Japvo in the Naga Hills as its culminating peak, 10,000 feet in altitude. Within this wall of parallel ranges numerous higher peaks occur with connecting spurs, which gather the ranges together like a great cobweb, and throw the rivers backwards and

forwards. The view seen from Japvo or any other lofty summit presents a vast undulating country, from which numerous gracefully conical peaks seem to ascend. The eye is unable to discern from a distance that this undulating region is a closely-packed mass of ranges, which are severed by the streams into deep dark gorges sinking almost precipitously for 2,000 to 4,000 feet before the dark green and sullen waters are reached. A few days' marching across these ranges (and the roads such as they are, all stubbornly do cross the ranges) soon conveys a practical conception of the character of Manipur.

From the foregoing observations, it may have been inferred that I desire to speak of Manipur as consisting of three well-marked regions, *viz.*, *the western wall*, the *central undulating region of low hills and valleys*, and the *eastern wall.* I shall now deal with each of these divisions separately.

(1). THE WESTERN WALL.—Starting from Cachar on a journey to Manipur, the traveller proceeds by the Government road across a level plain nearly due east until the Barak river is reached. This has to be crossed by small native boats, although in the hot season the sandy expanse of half-a-mile may be even forded. Beyond the Barak, at the village of Luckipore (14 miles from Cachar, or as the town is more correctly called Silchar), the first distant view is got of the Manipur Hills; for during the march hitherto, the northern Cachar Hills to the left have occupied the attention of the traveller. These Manipur Hills are by the people of the plains known as the Kala Nagas, but by the Manipurís they are the Owhy-nanglong. They rise up like a dark wall, well deserving the name "Kala," and completely cut off the eastern view. Immediately on leaving Luckipore, the road enters the low undulating hills known as the Hurung, beyond which a tract of country has been cleared for tea planting. On the hotter exposed rocky situations the shrubby feature of the Rajmahal Hills occurs—*Woodfordia floribunda*, *Helicteres Isora*, *Justitia Adhatoda*, and such other well-known plants abounding. Few, if any, trees are met with, that appear indigenous, although moringa, jack and mango are cultivated; and near the villages, the bamboo planted for shade, grows magnificently in tall gratefully shading avenues. In the more sheltered nallas which have apparently been denuded of their trees by the planters, but otherwise left with their rich vegetation—a profusion of ferns and grasses—a new and surprising feature exists in the tree ferns and large-leaved curcumas with a species of maranta (called by the natives *murta*). The last Tea Plantation is that known as the Jírí Ghât, from its bordering on

the river of that name. The *Jírí* river constitutes the frontier of Manipur, and separates the State from British territory. During the dry weather it is fordable, but in the rains it swells until it assumes the form of a great seething rapid stream some 40 yards wide. On the further side ascending the hills to the north and south a vast expanse of forest land is seen to extend. This is known as the Jírí forest—the only forest in Manipur from which timber is obtained. The other forests are too far away to be of any real use, and even in the Jírí forest the difficulty of removing the timber is very great. On crossing the river the road plunges into the forest, a long straight path through a dark, damp, flat expanse, carrying the traveller to an open glade where the Jírí river is again met with after having made a great bend to the east. Every now and then the road approaches the immediate bank of the stream which flows silently along its deep bed almost hidden by tall overhanging grass. Of the whole journey to Manipur, the part through the Jírí forest is the most difficult. Numerous streams flowing in damp muddy channels have to be crossed, and while the country does not ascend so as to reach above the malarial influence, it undulates sufficiently to make travelling troublesome. In November when I passed through the forest, the river and its tributary streams were all swollen, and at the same time a torrent of rain was pouring, which rendered the march as miserable as possible. On my return journey in May, I had also the misfortune to find it raining as hard as on the former occasion. Collecting specimens became thus an impossibility; but a diary was kept, and notes preserved of the trees and shrubs seen during the march. To the south of the road, it is generally stated that the chief tree of this forest is *Ficus elastica*, from which a considerable trade is done in caoutchouc. This fact is so uniformly repeated by all writers on Manipur, and was so consistently affirmed by all the natives I consulted, that there seems no doubt on the subject. Still I did not observe a single India-rubber tree in the part of the forest which the road traverses. Of the trees and bushes recognised, the following may be specially mentioned:—*Dillenia indica*, and a little higher up (met with near the bamboo forest of the next day's march), *Dillenia pentagyna*, its monstrous leaves contrasting gracefully with the feathery clumps. *Thespesia Lampas*, an elegant shrub with large yellow cotton-like flowers, is common in these forests, and re-appears again after the whole of Manipur has been crossed (say 200 miles due east) in the forests within the basin of the Ninghti. Along with *T. Lampas*, and abounding on the

damp muddy rivulet courses, occurs the bush *Kydia calycina,* and in the drier parts of the forest its associate *Helicteres Isora.* Overhead *Pterospermum acerifolium* spreads out its large maple-like leaves, and though not in flower, looked wonderfully well as seen from the higher undulations breaking the monotony of the heavy dark green foliage of its associates. On the return journey its long erratic flowers spread their fœtid odour everywhere ; but on that journey, interest was mainly concentrated on the dense clumps of the sacred 'Asoka' tree—*Saraca indica.* I had previously been familiar with this tree only as a garden plant in Calcutta, but I was charmed with its large modestly retiring clusters of elegant orange-red flowers seen below its deep glossy foliage. On the march up to Manipur these clumps of sombre foliaged trees were puzzled over, as from their not being in flower, they were not recognised. Not far off on the higher slopes, *Derris robusta* reared its head, displaying in profusion its elongated racemes of white flowers. Close by, also on the return journey, I was delighted to come across a new *Bauhinia,* which I named in my diary *Bauhinia tenuiflora.* As this species has not yet been published, it may be as well to give here a brief description of it. It is a large scandent bush, almost taking the place of *Bauhinia Vahlii* of other forests of this character, the whole plant having a thin ferruginous pubescence, especially on the young leaves. Leaves 9-nerved and about $\frac{1}{3}$ cleft on the apex. Inflorescence elongated, a corymbose-raceme, which as the flowers fall off bears below prominent scars. Flower stalk fully an inch long, and calyx tube from $1\frac{1}{2}$ to 2 inches—these two structures giving the flower an elongated tubular appearance possessed by no other Indian species of this handsome genus. Indeed it resembles most the Chinese species *B. corymbosa,* a fact of some interest, since a Chinese, or perhaps more correctly, a Malayan influence becomes more and more visible on wandering eastward through the Manipur State.

Every half mile forward the forest changes its character as the country ascends. *Mussænda glabrata,* an extensive climber, flaunts its long, white, leaf-like sepals over every bush and tree. The eye is gladdened with the flowers of *Tabernæmontana coronaria* (a familiar feature of the gardens of Bengal), with the clusters of white scented flowers of *Ixora nigricans*—a form of the plant which, in the character of the calyx, was found to differ so much from the type of the species as to almost justify its receiving a variety name. *Mussænda frondosa* and *M. macrophylla,* while less ambitious than *M. glabrata,* were on the return journey seen to speckle their surfaces, glow-worm-like, with their showy white

floral leaves. Along with these bushes, the stunted tree of *Sauranja Roxburghii* made its appearance—the first representative met with of the great family of the tea plant. As seen in these forests, this plant was devoid of the ferruginous tomentum usually ascribed to its leaves. Soon however it became associated with its near ally *Actinidia,* and a form of that genus which I first took to be *A. callosa*, but on comparison in the herbarium found to be a well recognisable variety, if indeed it should not be regarded as worthy of a specific position. *Meliosa pinnata,* a smallish tree with long pinnate leaves gave a new feature to these rich evergreen forests, which was greatly enhanced by the appearance of two species of *Elæocarpus, viz., E. amœnus* and *E. lanceæfolius.* Both these trees are exceedingly handsome—their delicately fringed, drooping corollas being quite unlike any of the other flowers seen, but the former has a scientific interest worthy of being here recorded. Hitherto *E. amœnus* has been supposed to be confined to the southern provinces and the western peninsula, and distributed to Ceylon, but not met with in the eastern side of India.

(*To be continued*).

# IMPROVEMENT FELLINGS IN THE DEHRA DUN SAL FORESTS.

## I.—Object of these fellings.

The growth of these forests is irregular, consisting of old hollow or diseased trees, badly grown, crooked, deformed saplings, many of them unsound, together with a certain proportion of straight, fairly well-grown stems, all of which, however, cannot be estimated as sound. The causes of this state of things are sufficiently obvious—ill-treatment in the past, removal of the best mature trees in the days of wholesale contractors, forest fires from time immemorial, grazing, climbers, &c. It is our duty as a Government Department to endeavour to improve these forests, and to hand down to posterity a large supply of well-grown sound timber. The object of these fellings is to do this. It is quite certain that this will also have the effect of largely increasing the revenue.

## II.—Necessary operations.

The necessary operations required to effect our object are as follows :—

1. Fire protection and limitation of grazing.

2. Climber-cutting.
3. Marking trees for sale.
4. Selling and removal of the produce.
5. Cutting-back and girdling.
6. Disposal of the material resulting from No. 5.

We will now take each of these heads in turn :—

1. These forests were first protected against fire in 1878 : they have consequently had the advantage of ten years' protection, and the result is a vast increase in the number of young seedlings and saplings which are sound ; in other words, there is a sufficient amount of advance-growth to justify us in marking the fellings. The means by which fire protection is ensured are described in Mr. Fernandez's "Manual of Indian Sylviculture," (pages 433 *et seq.*) and need not be repeated here.

Cattle are admitted to grazing in limited numbers during a portion of the year from the 1st July to the commencement of the fire season.

2. The next operation is climber-cutting. The two chief climbers in this forest are maljhan (*Bauhinia Vahlii)* and gauj (*Millettia auriculata*). The damage done by climbers is described in the "Manual of Sylviculture," pages 18 and 80—82.

Climber-cutting must be done at a time sufficiently previous to the felling that the climbers may become quite rotten by the time we wish to fell the trees. Experience shows that one full year may be a sufficient lapse of time to effect this, but it is safer to leave an interval of two years between climber-cutting and tree-felling. Thus a coupe, over which climbers were cut in November—March 1885-86, would be ready for felling in November 1887.

By that time the climbers would be quite rotten. This is a simple operation, and we need not dwell upon it longer. The nearer the climbers are cut to the ground the better, as it is gives less support to the new growth, and the top of the stool should be damaged as far as practicable, without wasting too much time on it, by smashing it with the head of the axe. Any new re-growth of climbers that appears will be dealt with in the cutting-back operations. There is some chance of the bark of *Millettia* being utilized as paper-making stock, and a possible sale of this material should be borne in mind.

Climber-cutting has to be done methodically under proper supervision, and it may well be done in April and May, as then we have a gang of men ready to hand in case of forest fires.

3. The next operation is the most important of all—marking the trees to be felled. The marking is done with the divisional

hammer, and every tree marked becomes the property of the purchaser of the coupe. Our five or six years' experience in this matter has enabled us to lay down the following rules:—

*Rule I.*—No tree, whether sál, sain, or kukat, under 6 inches diameter is to be marked. First, as regards sál and sain, this diameter of 6 inches, or girth of a foot and a half, is considered to be the maximum size above which sál and sain cease to send out useful coppice-shoots. No doubt they will coppice above this size, especially sain, but we then get a great number of shoots surrounding a large stool: they are hence weaker. What we want are one or two shoots on a small stool, because in these forests, owing to the quantity of seedlings in the advance-growth, there is no interest in obtaining any growth which will not eventually resemble a seedling. Now the cutting-back cannot be done by the purchaser, and it must be our work to do this: hence we cannot sell smaller saplings than this, or we might lose the re-growth altogether. Finally, the small saplings that have to be removed are very numerous, and we do not want to swell the total number of trees offered to the buyer by a large amount of almost worthless individuals. Although at the sale the trees are classified according to the size, the purchaser may be tempted by the large number to offer more than the coupe is worth. At one time we gave these small saplings away gratis; but there is no reason why this should be done, and the better plan is not to mark them now, but to remove them in the subsequent cutting-back operations.

Secondly, as regards kukat, there is no reason why these trees should not be marked, as we want to get rid of them and do not require a coppice-growth; but the marking and girdling of so many small trees take a long time and detract the attention from the more important operation of choosing the larger trees to be marked. They are worth very little to the purchaser of timber, and the correct principle is not to sell him such small and valueless material. We can get rid of them by girdling or felling in the subsequent operations.

*Exception.*—At the same time, if we notice kukat saplings overtopping and suppressing sound and straight-grown sál and sain seedlings, then we should girdle them, and also mark them with the hammer. But it must be remembered that we shall return to the coupe three years hence, and, unless the operation is a pressing and urgent necessity, it had better be neglected.

*Rule II.*—Any kukat tree that is suppressing, either directly or by lateral action, a sál or sain, or is likely so to affect a sál or sain within the next few years, must be girdled and marked.

*Exception.*—Certain trees that yield elephant fodder, such as the various figs, may be spared within a reasonable distance of the various camping places (say two miles). Also it will be as well to spare all individuals of *Terminalia Chebula* on account of the fruit it yields.

*Rule III.*—Other kukat trees, besides those immediately suppressing or injuring sál or sain, may be marked and girdled if they have a low dense cover like dhamin (*Grewia* sp.), or, if there are several in one group, we may mark some of them in the hope that seedlings of better species will produce themselves underneath.

*Rule IV.*—(Sál and Sain).—No growing tree in the prime of life is to be marked if it is straight, well-shaped, and completely sound and will not deteriorate during the next fifteen years.

The more we store up such trees—unhappily not very common—the richer fund are we laying up for the future.

*Rule V.*—(Sál and Sain).—Every tree which cannot improve during the next fifteen years, or which is now hollow, unsound, decaying, crooked, forked, &c., should be marked, subject to the proviso of

*Rule VI.*—No tree is to be marked the removal of which would cause a blank in the forest or increase an already existing blank; or in those localities exposed to frost, unless the advance-growth is sufficiently high not to suffer from frost (10 feet at least).

*Rule VII.*—Trees growing on the sides of a ravine, or at the head of a ravine, or on the edge of a cliff, should on no account be marked for fear of erosion.

*Rule VIII.*—We shall very likely find several sál and sain trees growing so close together that they interfere with one another's growth; in this case, although they may not fall under any of the above heads, we must remove some of them in order to admit of the better growth of the remaining trees. This can be only done by inspection and consideration on the spot. We must, of course, remove the worst ones.

The method of recording the trees marked and the manner of marking and measuring them can only be learnt in the forest itself.

4. The trees are marked during the working season, generally from December to March, and are sold by auction in August to the highest bidder. They are now sold altogether—sál, sain, and kukat in one solid lump. The purchaser is allowed twenty months in which to fell and remove the produce, and his operations last till the end of May in the second year after the auction.

5. It is then too late in the season to do any cutting-back, so this operation is not commenced till December or January of the next cold weather.

The felling and export operations have broken or bent a large number of seedlings and saplings of sál and sain, and we have, besides, all the saplings under 6 inches diameter which were left in the marking. We now deal with these two categories at once :—

*Rule I.*—All unpromising seedlings and saplings of sál and sain should be carefully cut back in accordance with the instructions given in the "Manual of Sylviculture," under Coppice, pages 401—405.

*Exception.*—If we find such growth under tall sound trees of the same species, then we leave it untouched, as their re-growth would not prosper under this taller crop.

*Rule II.*—The kukat saplings and young trees under 6 inches diameter may either be girdled or cut down about 2 feet from the ground (so as not to coppice). If it is found necessary to remove larger kukat, they should be girdled.

But as we must not create blanks in the forest, this rule will only apply to cases where young seedlings or saplings of sál or sain are found underneath, and not even then in frosty localities, unless the better growth is above the reach of frost.

*Exception.*—Wherever we find straight young saplings of kukat timber species (Jaman, Anogeissus, Haldu, Dhamin, Lagerstrœmia,) which are not actually suppressing sál and sain saplings, we may leave them untouched, or we may even cut back unsound specimens of these trees under one foot girth, in places where they are isolated and the re-growth will not interfere with sál or sain ; but this should be carried out in moderation.

*Rule III.*—All climbers are to be cut ; wherever small enough they are to be pulled up by the roots. In some cases a re-growth will have sprung up from the old stumps of climbers originally cut, and numerous pre-existing seedling climbers will have developed. This is the opportunity for getting rid of all such.

6. The material which results from the last-mentioned operation should be dragged to the nearest export line and placed in stacks, assorted. The small poles of sál and even kukat are generally saleable. The smaller branches must be left on the coupe, and, when dry, their export will be undertaken by fuel purchasers ; but no carts should on any account be admitted.

The following statement shows the various operations simultaneously going on in five adjacent coupes :—

*Series of Coupes.*

<table>
<tr><td rowspan="2">E.</td><td rowspan="2">D.</td><td>B.</td><td rowspan="2">A.</td></tr>
<tr><td>C.</td></tr>
</table>

A.—Climbers cut in January 1885.
Trees marked in January 1886.
Trees felled from November 1886 to March 1888.
Subsequent operations in January 1889.

Thus in January 1889 we have the following operations going on :—

Cutting-back and girdling in A.
Tree felling in B and C.
Tree marking in D.
Climber-cutting in E.

DEHRA DUN :
*April* 1888.

A. SMYTHIES.

## DOES THE CUTTING DOWN OF A FOREST ON A HILL DECREASE THE QUANTITY OF WATER GIVEN OUT BY THE SPRINGS AT THE FOOT OF IT?

THE above question would generally be answered in the affirmative, though in a late number of the "Forester" it was stated that a Madras official held the opinion that it made no difference whatever to the springs. My object in calling attention to this subject is to point out to the Professors of the Forest School at Dehra that they have at their very doors the means of helping to settle this question. The water used for drinking purposes in Dehra is carried from springs at a place called Nalapani, some 2¾ miles north-east of Dehra. The springs are in fact at the bottom of the hill, on which stood the fort of Kalunga, the taking of which from the Gurkhas under Bulbhudr, in the latter end of 1814, cost the British Army the lives of General Sir R. R. Gillespie, 8 officers and 60 men, besides of wounded 22 officers and 849 men, many of whom died afterwards from the wounds received.

When visiting the site of this fort it is very difficult now to realise the state of things that took place there in 1814, all is so peaceful and quiet all around; but feelings of indignation will

arise at the bad management that cost so much life and suffering; but it is not the bad management of former times alone that arouses indignation, very bad management is as evident now, but instead of men being destroyed, it is trees that have been destroyed, for the whole of the hill above the springs, has been ruthlessly swept clean of the sál trees that used to cover it, there is no reproduction, and the top and the upper slopes are being ploughed up, and the only source of sweet water for a progressing town like Dehra is being partly ruined for a little paltry gain.

In 1880 a scheme was worked out by the then Executive Engineer of the Dún Canals to bring the water from these springs into the town by pipes, and covered channels. He gave the supply as being in April and May 11,812 gallons daily, and in December and January 19,138 gallons, so that taking the population of Dehra at 10,000, this supply gave only 1·18 gallons per head in the hot season, and 2 in the cold season. This water would about do for drinking and cooking purposes; but for the drinking water for cattle, washing and other household purposes, the Raspanna water, which flows through the town in open channels, must be used: this water, it can be easily understood, gets very foul before it gets far through the town; the drinking of it without first boiling causes goitre, in the rains it is half mud, and it is so hard during the dry weather that it is not a pleasant water to wash oneself with, even with the aid of Pear's soap!!

The Executive Engineer proposed to build retaining walls at the springs, and so collect all the water into a masonry tank, and he hoped that this would increase the supply by some 25 per cent. At this time nothing further was done for want of funds, and the scheme was allowed to remain dormant till 1884, when the present District Engineer remodelled the alignment of the pipes, and cheapened the cost. In sending up the estimates he remarked as follows:—"There is an undoubted diminution in the actual discharge of the Nalapani springs, but this is certainly due to the whole of the trees in the neighbourhood of the spring having been cut down (*i.e.*, excepting a few trees close to the source), but as young trees are already springing up, it is expected that in a few years the supply will be as full as ever." He gives the minimum discharge as that on the 11th of June, 1884, when there was 8,640 gallons per day, and the maximum on the 2nd August, 1884, 51,050 gallons. The difference in discharge during May and June is not much, so the loss in the minimum supply was 3,172 gallons per day, or nearly 27 per cent., all owing to the cutting down of the trees. Last year the impounding walls and tanks for the head-

works were completed; and the supply taken on the 18th of June this year was 10,281 gallons per day, being an increase of 19 per cent. over the measurement made on the 11th June, 1884. This increase is clearly due to the construction of the impounding walls to a depth of 8 feet below the surface level; and is only a little less than what the Executive Engineer expected it to be. It certainly is not due to the growth of trees that the District Engineer looked to, to increase the supply, for though the trees were cut down 5 or 6 years ago, there is no reproduction whatever, the stumps of the sál trees are dead, part of the ground has been ploughed up; on part the usual scrub bushes that grow anywhere are dotted about here and there, while just above the springs there is a very large patch without an atom of vegetation of any kind on it; this is said to have been the site of a *cholera camp* of the Gurkhas last year.

The whole of the 10,281 gallons per day is not to go into Dehra, a small spring, giving on the 18th June 835 gallons per day, is left for the 12 villages near the springs, so that 9,446 gallons per day will be taken to Dehra for the 10,000 inhabitants; this is far too little, especially as it is believed that there are more inhabitants in Dehra now than there were when the estimate of 10,000 was made in 1880, and the number is rapidly increasing. The Municipal Board should at once take up, under the Land Acquisition Act, the land of this hill, and make it over to the Forest School, to be replanted with sál, and preserved and studied. As the pipes now being laid discharge the water into a reservoir a short distance from the Forest School, there would be no difficulty in keeping a record of the supply, and the Forest Department would by and bye be able to prove that the forests, lands and springs in the North-Western Provinces act in a natural way; and not "contrariwise" as they are made all to do in the benighted Presidency.

A. C.

A. C.

---

## NOTES ON THE SMALL BAMBOOS OF THE GENUS *ARUNDINARIA*.

Of the genus *Arundinaria*, which includes, according to the "Genera Plantarum," also *Thamnocalamus*, there are ten fully described Indian species, besides four which have only so far been named from leaf specimens. Of these fourteen species, one is South Indian only, one Burmese, and three occur in the North-West Himalaya, all of them extending eastwards into Sikkim. Eight species, including these three, are found in the North-East

Himalaya, one of them occurring in the Khasia hills also, making, with four endemic species, five for that locality. They are all small reed-like bamboos, but one or two of them, such as *A. racemosa* and *A. Hookeriana* have occasionally culms of over an inch in diameter.

The following analysis, based upon that given by General Munro in his "Monograph of the Bambuseæ," will serve to identify the nine fully described kinds, which occur in the Western Peninsula.

Branches of the inflorescence without bracts.
  Leaves and flowers on the same culm.
    Style 3-fid. Transverse veinlets very conspicuous— 1. *A. racemosa.*
    *Style 2-fid. Transverse veinlets conspicuous.*
      Nodes not prickly, internodes nearly glabrous, scabrid— 2. *A. Wightiana.*
      Nodes prickly, internodes woolly at top— 3. *A. Griffithiana.*
  Leaves and flowers on separate culms.
    Leaves narrow, few or no transverse veinlets.
    Leaves hairy along midrib, empty glumes nearly as long as the spicula— 4. *A. falcata.*
    Leaves glabrous beneath, empty glumes scarcely one-half the length of the spicula— 5. *A. khasiana.*
  Leaves broader; transverse veinlets somewhat prominent.
    Spicules 2–3-flowered. Nodes without a raised ring, internodes 5–6 inches— 6. *A. intermedia.*
    Spicules 1½-flowered. Nodes with a raised ring, internodes 7-8 in.— 7. *A. Hookeriana.*
Branches of the inflorescence with bracts.
  Transverse veinlets faint or none, bracts short— 8. *A. Falconeri.*
  Transverse veinlets prominent, bracts long— 9. *A. spathiflora.*

Besides these nine, a tenth, *A. elegans*, Kurz, occurs in the Nattoung hills in Burma from 5 to 7,000 feet, and the four species of which the leaves only are, so far, known, are—

11.—From Bhutan, a species with very small leaves, discovered by Griffith, and stated by him to be especially plentiful on the Dhonglaila Pass between 6,000 and 10,000 feet— *A. microphylla.*

12.—From the Khasia hills at 4,000 to 4,500 feet, collected by Griffith and Hooker, and especially near Moosmai waterfall. It

has very narrow thin leaves, 2 to 3 inches long by only ¼-inch broad, and the transverse veinlets very faint and distant— *A. suberecta.*

13.—From the Khasia hills: Vern.—'Uskong,' collected at Moflong by Hooker— *A. callosa.*

14.—From the Khasia hills, collected by Hooker and Griffith at 5,700 feet, and by Clarke at Shillong, 5,500 feet. It has fairly large reticulate leaves with long ciliæ at the top of the sheaths and spiny stems with broadly auricled short sheaths— *A. hirsuta.*

Mr. C. B. Clarke has also a Khasia hills' species from Shillong wood, which is, I think, *A. callosa.* It has spiny stems like *A. Griffithiana*, and bracteate flowers, so that it will come into the section *Thamnocalamus*, between numbers 8 and 9. The transverse veinlets are very conspicuous, and the sheaths (*Fig.* 7) have a broad apex and ciliate ligule.

It is unnecessary to say much regarding the two chief species of the North-West Himalaya, *A. falcata* and *A. spathiflora*, for they have been fully described by Brandis in the Transactions of the Royal Society of New South Wales of 7th October, 1885 and the "Indian Forester" for May 1886, in which he has fully cleared up the difficulty which existed in their identification and separation. But the Darjeeling and North-East Himalayan species generally are less known, and a few notes regarding them may usefully be recorded.

The common small bamboo of Darjeeling, known as "Maling," and whose leaves are so generally used for feeding ponies about that station, is, according to my identification, and as I have stated in the "Manual of Indian Timbers," *A. racemosa*, Munro. It has only once been collected in flower, *viz.*, by Griffith's collectors on Birch Hill at Darjeeling in 1837. Since then 50 years have elapsed, and it is curious that in that long period the flowering should not have been again recorded. Griffith's specimens were very poor ones, so that good examples are much required. Darjeeling Forest officers should keep a look-out for it therefore, and remember that keepers of Herbaria, almost all over the world, will be glad of specimens. The Maling bamboo has a stem of some thickness, usually about 1 inch in diameter, but often somewhat more. The internodes are rough and rather long, reaching to 15 to 18 inches. The straw coloured, brown, hairy, rough sheath of the young stems is ciliate on the edges and blunt at the top with a long fimbriate ligule, is about half as long again as the internode, and bears a subulate apex which is usually recurved (see *Fig.* 1). The leaves are sometimes rather large, up to

about 6 inches long and ¾-inch broad, and they have very conspicuous transverse veinlets which are raised beneath. This bamboo grows gregariously on the hill sides, and the growth is almost impenetrable; it may be seen in perfection on the slopes of Mount Tonglo on the Nepal frontier range. The stems are very largely used for mat and basket work, for building native huts, and for fencing, and the leaves are an excellent fodder. Its range is restricted to Eastern Nepal and Sikkim from 6,000 to 10,000 feet elevation, and it already begins to get scarce east of the Teesta river.

The common small bamboo of the higher parts of the Nilgiri hills above 5,000 feet is *A. Wightiana*, Nees. It is also a gregarious species, and gives a very dense cover, such as may be well seen on the higher parts of Doddabetta and on the Kundahs, as for instance on the upper slopes of the valley of the Avalanché stream. It flowers annually, the flowers appearing on leafy stems in dense purplish panicles with capillary somewhat twisted pedicels. The stems are about ½-inch thick, the internodes about 12 inches long, and very rough, the nodes swollen and with a conspicuous ring formed by the base of the fallen sheath, below them. The sheaths are often very rough, and are blunt at the top with a row of stiff ciliæ. The leaves are 3 to 7 inches long and ½ to 1 inch broad, the transverse veinlets very conspicuous. Beddome says that it dies down annually after flowering, but this point requires further investigation. Locally, it is spoken of as a "reed," and is sold as such by the Forest officers, but it is not much used. It is a handsome species, well worthy of cultivation.

*A. Griffithiana*, Munro, is a species of the Khasia hills, remarkable for a ring of thorns round the joints of the culm and thick tawny wool below the joints. It flowered in 1833 when it was collected, so says Munro, by the Assam deputation for the examination of the tea plant, under Drs. Wallich and Griffith. Hooker also got it at Moflong, but in leaf only. The leaves have transverse veinlets.

*A. falcata*, Nees, is found in the North-West Himalaya at from 5,000 to 7,500 feet. It is also, according to my identification, the "Titi nigala" of the lower Darjeeling hills, where it may be seen to perfection in the forests which lie in the square formed by the Reyang, Teesta and Sivoke rivers and the Latpanchor ridge, and also on the dry faces of the precipitous slopes overlooking the plains at about 2,000 feet elevation. It flowers annually, the flowers being small and somewhat resembling those of the rice plant though usually of a reddish colour. The stems are thin but

strong and with only a small cavity ; the internodes are usually 10 inches long and the joints are swollen. The sheaths are about 12 inches long, gradually narrowed into a point with a subulate apex, they are very thin and paper-like, and hairy at the top. The leaves are small, up to 4 inches long by ½ inch broad, are hairy and have no transverse veinlets. This bamboo is used for basket work, but less so than some other species. The Lepchas also use it for arrows, and for any purposes for which strong material is required.

Closely allied to the last species is *A. khasiana*, Munro, which is, however, recognisable by having glabrous leaves and different flowers. It is rare in Sikkim. I have specimens from Rungbee which I identify as this species, but it is possible that they may have been gathered from planted clumps in the Cinchona Plantations. The stems are like those of *A. falcata*, and thick and strong, but the internodes are only 7 to 8 inches in length. The sheaths (see *Fig.* 3) are papery, straw coloured, narrowed upwards but bluntly truncate, and with a long thin apical leaf. The leaves are larger than those of *A. falcata* and have no transverse veinlets. This species was collected in flower in 1850 by Hooker in the Khasia hills ; by Masters in Assam in 1839 ; in Sikkim by Hooker (at Purmia-chu) in 1848 ; by Anderson and Kurz in 1868 ; by Dr. Treutler in 1874 ; and by myself in 1879. It probably flowers yearly like *A. falcata*.

On the hills of the Dumsong Sub-Division about Dumsong, Rissoom, Khampung and Labah is a gregarious species which I found in flower in 1882, and which I identify as *A. intermedia*, Munro. In the locality mentioned, this species appears to take the place above 7,000 feet of the "Maling," and is known by the Nepalese name of "Deva nigala." The culms are usually yellowish, about ½–¾ inch in diameter, and have internodes of only 5 to 6 inches in length ; but they are strong and the cavity is small. The sheaths taper gradually to a blunt ciliate ligule with a short broad apical leaf (*Fig.* 4 enlarged from a small one). The leaves are small, up to about 4 inches in length and ½ to 1 inch broad and have transverse veinlets. Specimens of this bamboo were collected by Hooker in 1848 or 1849, so that 33 to 34 years elapsed between the two recorded flowerings.

The most handsome of the Sikkim Arundinarias is probably *A. Hookeriana*, Munro, a fine tall species known to the Nepalese as "Singhani" and to the Lepchas as "Prong." It is found here and there on the western side of the Teesta, but is most common to the east and on the hills overlooking the Teesta and Rushett

rivers at an elevation of 4 to 7,000 feet. It is easily recognised by its glaucous green culms, which have a blueish colour below the nodes under a raised whitish ring. The culms have large cavities and are soft; they are ¾ to 1 inch in diameter, and the internodes are 7 to 8 inches long. The old sheaths are easily recognised, for they have parallel sides for about half their length, and then taper gradually upwards to a fine end surmounted by a short blunt ligula and a subulate recurved apical leaf (*Fig.* 5). The leaves are rather larger and broader than those of other Darjeeling species, and they have conspicuous transverse veinlets. This bamboo has only been collected in flower by Hooker in 1848 or 1849 in Sikkim and East Nepal, and consequently if it has not already done so, it ought soon to flower again. It should be carefully watched for, and the leaves belonging to the same clump should be collected with the flowering branches, for those hitherto collected have been from separate plants. The seeds of this species are said to be edible, and the culms are used for basket work. It is a species which should be planted in gardens: I remember planting some, with other interesting kinds, in the Birch Hill Park and in other places at Darjeeling, but am unaware if they have thriven or not.

*A. Falconeri*, Bth., is a rare species, hitherto only known from Kumaun (Strachey and Winterbottom, 1848), and Nepal (Wallich, 1821), but C. B. Clarke has kindly given me specimens, which I identify as this species, and which were found in 1876 at Laghep in Sikkim at 9,000 feet, in flower. It is easily recognised from *A. spathiflora* by the much smaller bracts and by the spiculæ having only one complete and one rudimentary flower. The leaves are narrow and small, up to 4 inches long and ½ inch broad, and the transverse veinlets are not conspicuous.

*A. spathiflora*, Bth., is a well-known North-West Himalayan species, found between 8,000 and 10,000 feet, and, as Sir D. Brandis points out, is the true "Ringal" of commerce. It also occurs in abundance in the Darjeeling hills on the Singalila range, above 8,000 feet, where its yellow culms and red branchlets easily distinguish it. The culms are narrow, less than ½ inch in thickness, and the internodes usually about 6 inches long; but they are strong, and are used by the hill people for pipes, arrows, &c. The leaves have conspicuous transverse veinlets, and are short and rounded at the base. The old sheaths are rectangular below and rounded at the top, and have a long subulate apical leaf (*Fig.* 6). In the North-West Himalaya, this species flowered in 1848, 1863, and 1881, so that the period of its life is from 15 to 18 years. In Sikkim it apparently flowered in 1868. This also was introduced

by me and planted at Darjeeling, but I am unaware if it has succeeded or not.

The figures of the sheaths of seven species will show that they give characters by which they may be recognised. I regret I have been unable to figure the sheaths of *A. Wightiana*, *Griffithiana*, *Falconeri*, *elegans*, *microphylla*, *suberecta* and *hirsuta*. Of the last named, however, there are specimens in the Kew herbarium which show characters quite different from those of the other species. They are short, with stiff hairs and a broad blunt top surmounted by a broad, foliaceous, ciliated apex. The drawings of the sheaths of *A. callosa* and *intermedia* were made by enlarging those found on leaf-bearing shoots, and might perhaps require some modification. The rest are to scale from actual specimens, mostly in my own herbarium, or from drawings made by me in the forest.

The sheaths of *A. racemosa* are very rough and covered with shining brown spicular hairs, which are very unpleasant to handle, as they produce somewhat the same effects as those on the pods of the "cowhage" (*Mucuna pruriens*); the ligule is long and deeply fimbriate, and the apex or apical leaf narrow. The sheaths of *A. Wightiana* have similar irritating hairs to those of *A. racemosa*. The sheaths of *A. spathiflora* are also very well marked, as they are rounded at the top with a short fimbriate ligule and narrow apex. Those of the four species *falcata*, *khasiana*, *intermedia* and *Hookeriana*, are more nearly resembling each other, but may thus be separated—

Apex very short— *A. falcata.*
,, medium-sized, broader in the middle—*A. intermedia.*
,, long, narrow.
Sheaths long—up to 16 inches— *A. Hookeriana.*
,, shorter ,, 10 ,, — *A. khasiana.*

The sheaths of the small bamboos of other genera, such as *Phyllostachys, Cephalostachyum* and *Pseudostachyum*, differ again so much that there is not much danger of mistaking them. I hope soon to be able to figure them in the pages of this Journal. As a means of distinguishing the chief species, without flowers, I have attempted an analysis which will, I think, serve the purpose—

A—Burmese species only— 1. *A. elegans.*
A′—South Indian ,, ,, — 2. *A. Wightiana.*
A″—North Indian (Himalaya and Khasia hills).
B—No, or very faint transverse veinlets.
C—Transverse veinlets none.
D—Leaves hairy along the midrib, apex of sheaths very small— 3. *A. falcata.*

D′—Leaves glabrous, apex of sheaths long— 4. *A. khasiana.*
C′—Transverse veinlets faint, distant, scanty.
D—Leaf sheaths ciliate— 5. *A. suberecta.*
D′—Leaf sheaths not ciliate— 6. *A. Falconeri.*
B′—Transverse veinlets distinct, leaves at least 3 inches long.
C—Nodes thorny, internodes with tawny wool at the top— 7. *A. Griffithiana.*
C′—Nodes not thorny.
D—Shoot sheaths with very large auricled apices— 8. *A. hirsuta.*
D′—Shoot sheaths with narrow, subulate apices.
E—Sheaths rounded at top— 9. *A. spathiflora.*
E′—Sheaths pointed, truncate at top.
F—Internodes and sheaths rough— 10. *A. racemosa.*
F′—Internodes and sheaths smooth.
G—Apex broadest in the middle.
H—Ligule fimbriate— 11. *A. callosa.*
H′—Ligule blunt— 12. *A. intermedia.*
G′—Apex broadest at base— 13. *A. Hookeriana.*
B″—Transverse veinlets distinct, leaves shorter than 3 inches— 14. *A. microphylla.*

It is probable that a study of more numerous specimens, especially of the Khasia species, may detect errors in the above and lead to modifications, but as it is, it may prove useful. After all, as in the same locality, it is rare to find more than two or three at once, the determination can be simplified. In the North-West Himalaya, as Brandis has shown, there are two common species, *viz.*, *A. falcata* and *spathiflora*, and these are at once separated thus—

Flowers annual. Leaves without transverse veinlets, sheaths long pointed— *A. falcata.*
Flowers not annual. Leaves with transverse veinlets, sheaths rounded at top— *A. spathiflora ;*

while *A. Falconeri*, while having only very faint transverse veinlets, has not the annual flowers of *A. falcata.*

In the Darjeeling hills the high level species are *A. spathiflora*, *racemosa*, *intermedia* and *Hookeriana*, and these may be thus distinguished—

Stems smooth, yellow, branchlets red, sheaths rounded at top— *A. spathiflora.*
Stems rough green, sheaths strigosely hairy, ciliate— *A. racemosa.*

Stems smooth, yellowish, thick-walled, leaves narrow— *A. intermedia.*

Stems smooth, bright green, thin-walled, with a blue ring below node, leaves broader— *A. Hookeriana.*

In the same region the low-level species *A. falcata* and *A. khasiana* differ from the high level ones in the want of transverse veinlets and from each other thus—

Leaves hairy along midrib below, apex of sheath very small— *A. falcata.*

Leaves glabrous along midrib below, apex of sheath longer— *A. khasiana.*

The species of the Khasia hills are thus distinguished—

No transverse veinlets, ligule blunt— *A. khasiana.*

Faint transverse veinlets, ligule ciliate— *A. suberecta.*

Transverse veinlets distinct, leaves very small— *A. microphylla.*

Transverse veinlets distinct, sheaths long, smooth, ciliæ few, short— *A. callosa.*

Transverse veinlets distinct, sheaths short, strigose, ciliæ many, long— *A. hirsuta.*

These graceful little bamboos form a very interesting group, some of the members of which are in cultivation and flower in gardens in England. The chief cultivated kinds are *A. falcata* and *A. Falconeri*, though the species most commonly met with and found to be perfectly hardy in the open air is the Japanese, *A. japonica.*

More information regarding the life-periods of these plants is badly wanted, also is it important to know if, when the flowering season occurs in the case of the more widely spread kinds like *A. spathiflora*, it is universal or not throughout its range.

KEW, J. S. GAMBLE.

*February 29th, 1888.*

## DENDROMETERS.

THE April number of the "Indian Forester" contains a description of one of the many height-measurers which have been, and are still being, devised in Germany and France. The writer of that article gives no information as to the degree of accuracy attained by Weisse's dendrometer, but from his diagram—having never been fortunate enough to see the instrument,—I should think it must give a rather rough approximation, for the number of gradations shown (in the picture at any rate) is very small, and the

Fig. 2.

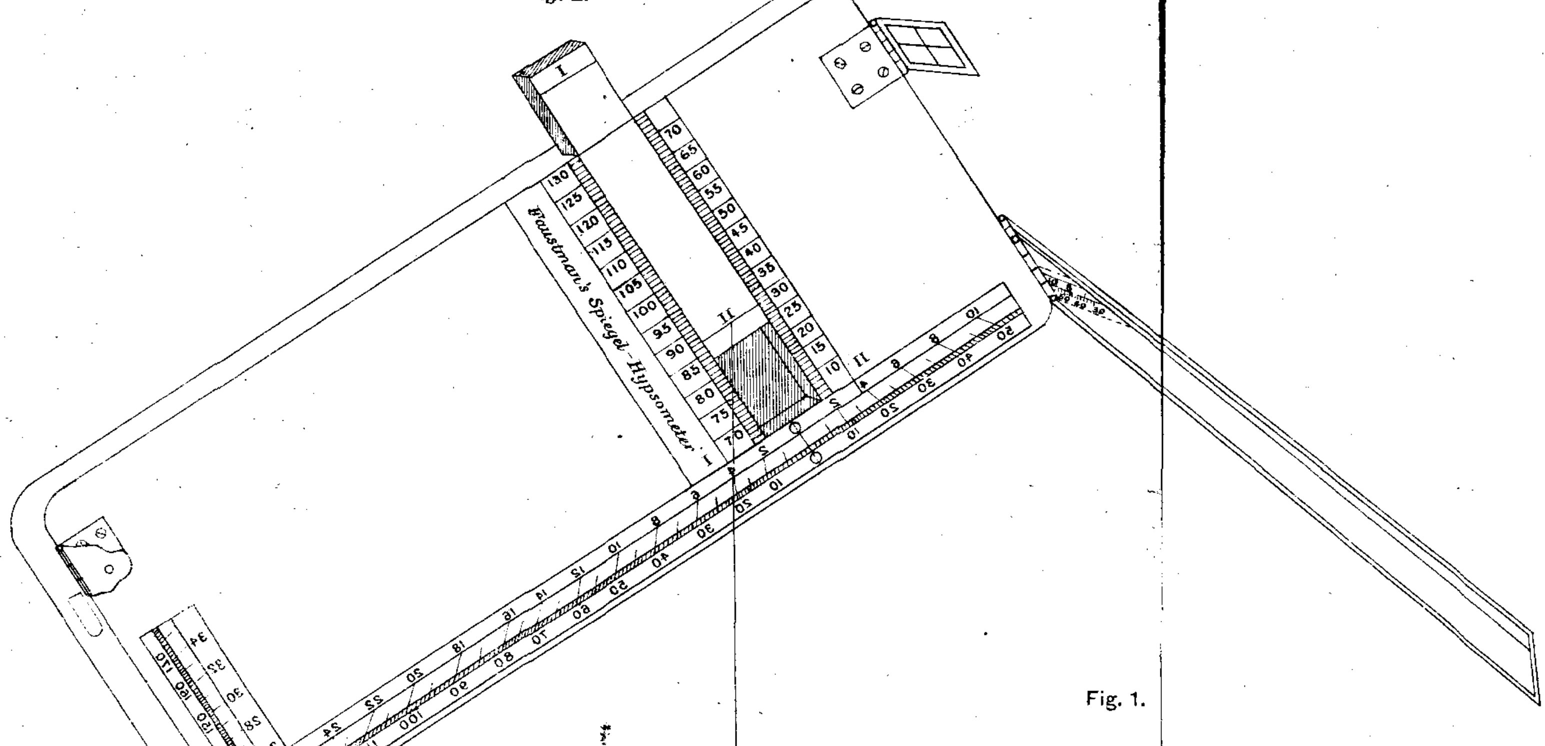
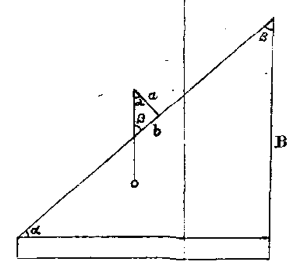



Fig. 1.



$$\frac{A}{B} = \frac{a}{b}$$

teeth which stop the pendulum—though very ingenious—must rather deter from the attainment of a great degree of accuracy.

It seems to me that a dendrometer, to be worth anything, should be qualified to give an accurate result. For every one with a *little practice can judge* the height of a tree approximately, and it is only when an exact measurement is required that a height-measurer is useful. Otherwise it were as well to dispense with instruments altogether, and simply to measure at sight or else by means of some of the simple processes which the natives themselves employ.

I have before me however a dendrometer which is at once very accurate, portable, and simple in construction. It is called Faustmann's Spiegel-Hypsometer.

This consists of a *small board* $7\frac{1}{2}'' \times 3'' \times \frac{1}{4}''$, *to which are attached* two little brass hinges, one at each end, which unfold, and give,—the one an *eye-hole, the other, a cross-wire:* between these, a slip of wood runs in a groove as shown in the figure, the groove bearing on either side a graduated table, 10 to 130, and the thread carrying the plummet (which when not in use, fits into a little cavity in the board,) is attached to the base of this sliding piece of wood, which, in order to take a measurement, is placed with its index opposite to the number corresponding to the base line measured.

*Along the bottom of the* board runs a scale of heights, about 26 graduations to the inch; while at the side is hinged a mirror in a metal case of nearly the same length as the board.

It is this very ingenious contrivance of Faustmann's which gives this instrument its character.

The mirror serves the purpose of the teeth in Weisse's hypsometer. For without moving the eye from the eye-piece, one can at the same time read in the glass, which is held with the left hand, the number where the pendulum intersects the scale of heights, and so a very accurate result is obtained. The numbers on the scale of heights are written backwards, so that when read in the mirror, they read straight.

The principle of the instrument is based on the same geometrical truth as Weisse's, and most other dendrometers. But the writer of the article describing Weisse's instrument is wrong in supposing that he would have to change his scale to read feet *instead of meters*. The height read is relative, not absolute. Whatever unit is used *for measuring the base line, the same* will be the unit for the height given. My dendrometer too is marked for meters, but is equally true for feet or fathoms.

In conclusion, I may remark that this instrument may be very usefully employed as a clinometer,—in plane-table surveys, for example.

H. JACKSON.

H. JACKSON.

## COMPOUNDING FOREST OFFENCES.

THE correspondence that has appeared in the "Forester" on the above subject is interesting from more points of view than one, and shows the truth of the old adage, *quot homines, tot sententiæ.* In every province there appear to be different methods of reading the law, and of applying it, but the procedure of "Gorarh" is the most extraordinary of all. What is the size of his Division? Is the Ranger empowered by the Local Government to hold an enquiry into forest offences? if not, "Gorarh's" plan appears to me to be illegal; it is most certainly entirely opposed to the spirit of Section 67; to understand this, read Mr. Baden-Powell's letter in the "Forester," Vol. VII., page 156, and his remarks on "Jungli Sahib's" note, same volume, page 298. It is clearly expressed here that only such cases as come under the Forest Officer's own cognizance, should be treated under Section 67, that is a case which he has personally investigated, generally going to the spot, seeing the damage done and estimating it, and examining the accused and the witnesses, such procedure in fact as is mentioned in the Editor's note, page 166. But "Gorarh" sitting in his office or camp many miles off, on the mere report of a Forest Ranger, has "settled thousands of cases," by what I maintain to be an illegal method; it is no doubt an effective method, saves trouble, and looks well in the record; but it is not Section 67 of the Forest Act.

I must say that with "Jungli Sahib" (VII., 156) I thought Section 71 (*b*) empowered us to issue summons to compel the attendance of witnesses in any case, and have always acted on this assumption; but it appears from Mr. Baden-Powell's note that I was wrong, as this power only refers to survey of lands, boundaries, &c. This point should be authoritatively settled one way or the other—we should certainly be empowered to summon witnesses for the prosecution, for they may not always attend as readily as they appear to do in the School Circle, N.-W. Provinces. The whole question of the administration and working of Section 67 is one that is worthy of the attention of the Inspector General of Forests; it would be interesting and instructive to compare the

different interpretations of the Section in the various provinces, and some more uniform method of action would be desirable. As to the utility of the Section, there do not appear to me to be two opinions possible, and if the honest "Ghati" had a smaller Division to look after, he would probably alter his verdict.

SINGLE S.

---

## FORESTRY AT THE CAPE.

MR. D. E. Hutchins, Conservator of Forests, King Williams Town, Cape Colony, writes as follows :—

I have to thank you for the consignment of box seed that, after some delay, at last came safely to hand. It looked all right, and I hope will germinate. As we have now a parcel post, would you kindly remember in sending me any seeds in future to send by parcel post. The boxwood seed was detained some time in London. I am sending you by this mail 5 lbs. of yellowwood (*Podocarpus latifolia*) and 5 lbs. of sneezewood seed (*Pteroxylon utile*). From the way that Himalayan trees grow on our mountain, I feel certain that both these trees will grow on the Himalayas. The yellowwood tree you would only grow for ornament or as a curiosity, but it is well worth your while to try and establish a culture of the sneezewood tree. The seed I send is from the large tree growing in the mountains. In these mountains all Himalayan trees seem to flourish, while on the low country between the mountains and the sea it is evidently too dry and hot for them. On the Perie mountains at 3,600 feet elevation, I have a collection of deodars and *Pinus longifolia* that have a curious history. The seed was originally sent some years ago by Sir Dietrich Brandis to the Grahams town Botanical Gardens. There the plants languished in a climate too hot for them, till they were liberally presented to me by the Curator, for planting on the mountains. A few months after being planted out, on the mountains, they took a new lease of life. Seemingly the growth now is all that could be desired. And it is pleasant for me to watch the development of trees, that I heard about in India, and yet left without even seeing.

Have you received our annual report, which I sent you, for last year 1886?

Can you put me in the way of obtaining a regular yearly supply of deodar seed? Perhaps you could tell me what would be the quotation per lb. in lots of about 20 lbs.

*4th March*, 1888.

## AUTHENTIC CASE OF FOREST FIRE CAUSED BY LIGHTNING.

THE following instance of a forest fire which came under my special notice may help to convince those who are still sceptical as to this cause of forest conflagrations.

At the Kandar block of the Lambatách forest of this Division on the 17th of May last, a flash of lightning was observed to strike a deodar tree, and shortly afterwards the grass round the tree was observed to be on fire by some villagers who were at work in a neighbouring field, and who promptly proceeded to extinguish the flames, and then reported the matter to the Forest guard, whose choki is situated some distance off.

On the 2nd of June I examined the tree, and found that there can be no doubt as to the firing of the grass through the agency of lightning. It should be noted that the tree was half dry, the base having been injured by fire on some former occasion, and was therefore in a very inflammable condition. In another part of the block a green deodar tree was also struck, and half of the tree knocked away, but in this case the grass did not catch fire. This is the second time that a fire has happened at this block, though a flash of lightning on the former occasion during 1884, a kail (*Pinus excelsa*) tree having been struck and the grass lighted, but the evidence was not quite so clear as on the present occasion.

E. McA. M.

---

## RATHI PUVU (ROCK FLOWER).

THE Rathi Puvu found in Bellary is probably identical with that found on the large rocks on Horsleykonda and Tettu hill in the Cuddapah District. Its use is unknown in the District, but some merchants from Anantapur export a few bandy loads annually. They pay a seigniorage of Rs. 2 per maund of 25 lbs., and sell in Anantapur at Rs. 10 or 12 per maund. In Anantapur it is eaten with curry, and is also used medicinally. The lichen is collected during the hot weather, *i.e.*, in April and May.

The business is very profitable, and the seigniorage rate might easily be doubled without causing any hardship to the merchants. Collection by departmental agency is being tried at present, and it is possible that this may induce the Anantapur merchants to make higher bids for the right of collection. The cost of collection and export is shown below.

| | | Rs. | A. | P. |
|---|---|---|---|---|
| Seigniorage on 40 maunds, ... ... | ... | 80 | 0 | 0 |
| Collection of do., at 8 annas per maund, | ... | 20 | 0 | 0 |
| Cartage to Anantapur, 80 miles, ... | ... | 8 | 0 | 0 |
| *Total,* | ... | *108* | *0* | *0* |
| Sale of 40 maunds, at Rs. 10, ... ... | ... | 400 | 0 | 0 |
| Profit, | ... | 292 | 0 | 0 |

CUDDAPAH,
*7th June*, 1888.

F. A. L.

## APPROPRIATION OF LAND UNDER SECTION 28 OF FOREST ACT.

A QUESTION has arisen whether lands in a Taluka in which the Revenue Survey has not been introduced can be placed under Section 28 of the Forest Act.

Proposals were submitted for notifying the lands as Protected Forest; but they were vetoed by a higher authority. According to Section 28, clause 3 of the Forest Act, (1878,) it would appear that no action can be taken until the lands have been surveyed, and the rights of Government enquired *into and recorded. But surely* there must be lands in other parts of India on a similar footing. And if there are, will some of your readers state what is done in those cases, especially if the forests are in danger of being rapidly destroyed.

One remedy of course would be to induce Government to introduce survey operations at once; but is there no other remedy?

*23rd May*, 1888. G. E. M.

*In Section 28 of the Forest Act, it is clearly laid down that* if the Local Government considers that enquiry and record are necessary, in the case of any forest, or waste land, but that such enquiry will occupy such length of time as that the rights of Government will in the meantime be endangered, it may, (pending such enquiry and record) declare such land to be a *protected forest,* but so as not to abridge or affect any existing rights of individuals and communities.—[ED.]

## CATTLE STRAYING INTO PLANTATIONS.

I THINK the following correspondence between myself and my Collector might be useful to Forest officers as giving the law of cases in which the only adequate compensation would be obtainable from

the masters. Thus if 100 cattle in the charge of a little boy go into a plantation, the least one could charge would be perhaps twice the daily rate, or 8 pies per head—total Rs. 4-2-8. Clearly in such a case the masters will have to pay, but as "Collector" says this is not obtainable from them criminally, but only as a *charge* for the material eaten.

A. G. HOBART-HAMPDEN.

I am continually being annoyed by large numbers of cattle straying into a plantation, and the herdsman in charge (when he is present) is always too poor to pay—my plan being to charge twice grazing dues, or some such thing. Are the masters liable?

FOREST OFFICER.

The masters are liable in a Civil Court—that is to say, if you can *charge* a double fee, they could be made to pay.

But if it is a *penalty*, and imposed by you at a Criminal Court, the masters, being absent and not proved to have instigated the act, would not be liable for the doings of their servants.

COLLECTOR.

---

SIR D. Brandis writes as follows:—

The seeds of *Quercus incana* have germinated, and have yielded healthy plants both here and at Heidelberg. Professor Pfitzer desires his thanks to be expressed to those who collected, packed and sent them. *Q. incana* will not live out of doors in Germany, but the two other oaks might, and I would now suggest, that as soon as they are ripe, small bags of ripe acorns with charcoal be sent by pattern post. Very likely, if they are despatched sharp, charcoal may not be necessary, and to test this I would suggest say two little bags of each kind with charcoal, and two such bags without charcoal being sent when *Q. semecarpifolia* and *dilatata* ripen.

Perhaps it might be worth while putting this notice into the "Indian Forester." It gave us the greatest pleasure when these acorns germinated, and they are now healthy plants with green sharply dentate leaves, upper side somewhat shining and grey, velvety underneath.

---

## TUNIS AND PERSIAN DATE PLANTS.

HAVING a large number of Tunis and Persian Date plants ready for planting, I request to know what possibility there is of their

being a success in a moist part of Tirhoot. This is a palm district, and many varieties do well.

I should be glad to hear if the date of commerce, *Phœnix dactylifera*, does well in any part of India, that is, does it produce marketable dates sufficient to pay expenses.

At the Lucknow Horticultural Gardens I believe they fruit yearly in the rains, and that the fruit rots on the plants, owing to the moisture, and does not come to perfection.

How do the plants answer in the Botanical Garden at Seebpore? I should be obliged if any of your numerous readers could give any information on the subject.

*22nd May*, 1888. J. B.

## FOREST TOUR OF COOPER'S HILL STUDENTS.

WILL any of the late arrivals from Cooper's Hill College of Forestry be so very good as to give me particulars on the following points :—

(i). The time the tour through continental forests extends over, and the month in which it usually begins.

(ii). Probable cost of the tour, allowing for everything. I shall be very much obliged for any and all information which can be given, as I intend going home to attend the practical course next year.

"OLD FINCHLEIAN."

TRAINING OF CEYLON FOREST OFFICERS.—The *Ceylon Times* remarks :—"The recently appointed Foresters—Messrs. Tatham and Hansard—have just received instructions to proceed to the Indian School of Forestry at Dehra Dun, in the North-West Provinces, to study forestry there for eighteen months. All their expenses are to be paid by our Government, and they will receive salaries as well; so they are very lucky to be given this excellent opportunity of acquiring a scientific training in their work."

## IV. NOTES, QUERIES AND EXTRACTS.

SKETCH OF THE FORESTRY OF WEST AFRICA, WITH PARTICULAR REFERENCE TO ITS PRESENT PRINCIPAL COMMERCIAL PRODUCTS.*— This work is offered as a humble contribution by the author, commemorative of the Jubilee of Her Most Gracious Majesty the Queen. He happily dedicates it to his wife, out of consideration of the self-sacrifice she exhibited in foregoing the society of her husband during the compilation of the work, which was carried out in his leisure hours.

It is a work treating of the forestry of West Africa, but in practice it reaches far beyond this line, and embraces a large part of the vegetable products of the colony, exhibiting some interesting side lights on the manners, customs, trading characteristics &c., of the inhabitants.

In reviewing the work for this *Journal* we shall, of course, confine ourselves to forestry and details strictly bearing upon timber.

Like most tropical countries the west coast of Africa produces an abundance of palm trees and dense or hard-wooded trees, mostly of the leguminous order, an order of which the laburnum, familiar to us in England, is a member. As a natural consequence the wood is mainly small in character. The African oak or teak (*Oldfieldia Africana*) is abundant in Sierra Leone and Upper Gambia, producing timber trees of good quality 15 feet in circumference of stem. Other trees are noted 10 to 12 feet in circumference; but, although the vegetation is vast, the great volume of the wood is small in diameter. Nevertheless the author does not endorse the description given of the country by pessimists and disparagers as the land of "bush." He quotes from Butter Sheet a description of a West African forest :—

"So vast is this vegetable kingdom, that the animal world sickens and dies out before it—this immense forest holds scarcely a living creature. For months I have trodden its labyrinths, and seen only a diminutive deer, a grey monkey, and a few serpents."

* By Alfred Moloney, C.M.G., of the Government of the Colony of Lagos. (London: Sampson Low, Marston, Searle, and Rivington, 1887).

A curious system appears to obtain in these settlements, inasmuch as the farmers are partially nomadic, moving from one district or farm to another as the land becomes impoverished or exhausted; as a natural consequence these exhausted farms become features in the landscapes. Our author says :—

"Land is worked on an average ten years, after which it is deserted for virgin soil. This period is made up as follows:—four or five years continuously after clearage by cultivation and harvest, two or three years to lie fallow, and the balance of the time to re-cultivation and fresh harvest, when the land is considered by the people as worn out."

This system has a direct bearing on the forest growths of the country, and clearing by axe and fire is constantly going on, added to which, from ignorance or indifference, trees of great commercial or economic value are largely destroyed.

It seems an ordinance that where the European sets his foot, his first office is to destroy the native timber. This example is speedily followed by the native races, who upon imbibing the first rudiments of civilisation, in the shape of cultivating the soil, immediately fall foul upon their native forests. Timber is a slow and unproductive crop, and must give way to plants that yield their returns in one season.

It is easy to see that as centuries roll on the natural covering of the earth disappears, and the climates become more dry, and the land more arid.

Our author informs us that the islands of St. Helena and Ascension are now denuded of their indigenous timber, and that the native trees remaining are of small dimensions, the foreign element being next to nothing and undeveloped.

"St. Helena was discovered by a Portuguese, Jean de Noya, in 1501; at that date it was entirely covered with forests, the trees drooping over the tremendous precipices that overhung the sea. Now nearly the whole of the indigenous vegetation has disappeared, except on the upper part of the central ridge, and is only very partially replaced by introduced plants, in consequence of the soil being washed off from its rocky foundation since the destruction of its forests."

"In South Africa, according to Colonial botanists' reports, millions of acres have been made desert, and more are being made desert annually through the destruction of the indigenous forests. In Demerara the useful timber trees have all been removed from accessible regions, and no care and thought given to planting others. From Trinidad we have the same story; in New Zealand,

there is not a good Kundi pine to be found near the coast, and *I believe the annals of almost every English colony would repeat* the tale of wilful, wanton waste and improvidence."

Our author says, "It can be stated, without fear of contradiction, that in our possessions on the coast of Africa the timber is rapidly and visibly diminishing, and that the adoption of steps for replanting and preventing waste has become worthy of early consideration." "It would be no hardship, and would prove highly advantageous, to impose as one of the conditions of lease, that in clearances for farm purposes, certain trees of known value should be uninjured, as far as practicable, either by axe or by fire."

One source of great destruction to the native timber is the supply of firewood, for which purpose the mangrove, a tree highly valuable for its sanitary qualities, is largely drawn upon. Firewood is difficult to secure in some districts, and is consequently becoming dear.

The pages of this book are eloquent in pleas for the preservation of forests as sources of wealth and of benefit to the climates wherever they are situate, and they are equally rich in regrets that the study of forestry is so much neglected in our schools. On this subject Sir Joseph Hooker is quoted as follows :—

"Forestry, a subject so utterly neglected in this country that we are forced to send all candidates for Government appointments in India to France and Germany for instruction, both in theory and practice, holds on the Continent an honourable, and even a distinguished, place amongst the branches of a liberal education. In the estimation of an average Briton, forests are of infinitely less importance than the game they shelter, and it is not long since the wanton destruction of a fine young tree was considered a venial offence compared with the snaring of pheasant or rabbit."

In the early pages of the work under review we find allusion to the home Government making official enquiries as to the capabilities of the colonies dependent on the British Crown in supplying timber for shipbuilding, railway works, general building, furniture, lathwood, &c. This was in the form of a circular despatch, dated June, 1874, emanating from the Commissioner of Woods and Forests. We there learn that like enquiries were made in the same year by *the Foreign Office, through Her Majesty's* representatives abroad, and that the result was compiled in the following year. These inquiries do not seem to have borne much fruit, as the Gambia and St. Helena alone responded. In the former, mahogany for shipbuilding is noticed ; rosewood and blackstick for boat and canoe building, the male species of "runs" for bridge and house building, mangrove for props, posts, and small vessels, black ditto for build-

ing native houses, cotton tree for canoes, and domestic utensils, &c. The forests are noted as being owned by the Government, and to be diminishing, owing to the operations of wood-cutters, that restrictive ordinances with regard to felling trees were in contemplation, and that the export trade in timber ceased with the introduction of iron in shipbuilding.

In the West African Settlements, as a whole, the export trade in timber still exists; but it is strange that France is a better market for the wood than England. One branch of this wood trade is dye woods, such as camwood, barwood, and red sandalwood, of which about 3,000 tons, value £15,000, were shipped to the United Kingdom in 1878, since which date the trade has declined owing to the increased use of dyes produced from coal tar-refuse.

From the Gaboon it is estimated that 40,000 tons of sandalwood and ebony are annually exported.

Mr. G. S. Saunders and Messrs. Gardner & Sons of London, who are associated with this West African wood trade, appear to have contributed valuable information to the author. From these sources we learn that barwood realises in London from £2 10*s.* to £4, or £2 15*s.* to £4 5*s.* per ton. This wood, besides its use in the dyeing trade, is worked up in Sheffield for knife handles, &c.

Camwood is extremely valuable, as it ranges from £29 to £35 per ton; black ebony from £4 10*s.* to £13 per ton, according to size, colour, and freedom from defects.

Our author writes :—

"Although West Africa has ceased—let us hope only temporarily—to form one of the timber centres as regards export trade, an extensive and important local timber industry proceeds, partly in the building of canoes and cutters for the river trades, and partly in the substitution of framed wood for mud and wattle houses along the coast line."

The prices of West African woods when they reach this country, mostly by steamers plying to Liverpool, appear very high, but it is a fact that with close application, with the view of developing the trade, a great advance in the direction of cheapening their cost might be made, for we learn that the finest of the woods, such as mahogany, rosewood, good hard and beautiful woods, &c., could be purchased at the Gambia at 2*d.* per foot (super. 1 inch thick). A list of many useful woods is given, in which the local prices under existing circumstances range from 1*d.* to 6*d.* per super. foot 1 inch thick.

The detailed particulars of the different kinds of wood produced by these West African Colonies and Protectorates are not very

lucid, and the index, which is a mere skeleton of the contents, does not render much assistance. For instance, if you turn to oak or mahogany you find neither, and any notice thereon has to be found in the text in the best way it can. The reviewer remembers, in reading the book, coming across a beautiful description of a tropical forest. He failed to note the page, and he has sought for it again and again in vain. A defective index is a great drawback to any publication, especially of the text-book type, of which the work under notice is no mean example.

The description of African oak or African teak is drawn from Lindley and Moore's "Treasury of Botany," and is very brief.

Of African mahogany we have the following note, bearing date 1832 :—"Fifteen years ago it was not known that mahogany grew in the Gambia. Since that period several thousand loads have been shipped to England from our settlements on that river, and although the natives would not at first prepare it for shipment, they are now willing to supply any quantity that may be required. This is the *cail-cedra* or mahogany tree of the Gambia (*Khayer senegalensis Juss*), a lofty tree, the wood of which is adapted for building, carpentry and joinery, and for turning.

Of other woods there are incidental notices, but they are not of that detailed nature that timber merchants would wish.

Amongst curiousities of timber we may note a shipbuilding and carpentry wood exported from Sierra Leone called "Pissaman," that is proof against the attack of marine animals ; another wood, called mool, the produce of a tree that yields vegetable butter; whilst another, bearing in Lagos the name of "Oroko," resists for years the destructive action of the "white ant." Perhaps the most curious is a member of the Screwpine family, the *Fanjahnee* (Mandingo) of the Gambia, or self-fire-consuming tree, abundant in Upper Gambia. The natives assert that the fruit, when matured, bursts, causing spontaneous combustion, which often destroys the tree and desolates the site. No Mandingo would have such a tree in his compound as it is more treacherous than a firestick.

Lastly, we may note the Mozambiti lignum vitæ, a large tree, the wood of which is dense, close-grained, and very heavy, with a deep reddish-brown heartwood and a light sapwood. The ash left on burning the wood is used by the Portuguese as white-wash for houses, and by the natives to reduce the acidity of the native tamarind pulp.

This particular coast affords a reflex of man in his primitive state in the veneration in which large trees are held by the natives, and the consequent immunity they enjoy from the destructive action of

the axe. This feature is most prominent in the Yoruba country, where it refers to the *Oroko*, *Afon*, *Araba*, *Ashori*, and other large trees.

A most interesting side of the timber question is the requirements for wood in a raw and manufactured state from outside sources, which is growing upon these colonies. These are very ably dealt with by the author, who seems to write in a tone of regret that the requirements are not met by local means, although it is clear that, without this augmentation, the country is being rapidly denuded of its natural growth of wood for home consumption.

We find that Sweden figures prominently in this import trade.

Mr. Dering, reporting on the Forestry of Sweden and Norway, says :—

"There is hardly a maritime country in the world, with the exception of China and Japan, to which the produce of Swedish forests does not appear to find its way."

Our author says, "Swedish and Norwegian vessels regularly find their way to this coast." Statistics are given for 1872 ; but as they apply to the whole or our African possessions, they are of very little value when applied to the west coast only. Deals and planks, planed boards, and beams and spars, are the principal articles shipped ; but a good deal, no doubt, reaches the coast, more or less in a manufactured state, from Great Britain.

A considerable import of staves and empty casks is carried on, and we find in 1885 as follows :—

| | | | |
|---|---|---|---|
| Staves and empty casks, | Foreign, ... | ... | £62,300 |
| ,, ,, ,, | British, ... | ... | 15,966 |
| Wood unenumerated, | Foreign, ... | ... | 13,545 |

The Americans do a considerable trade along the West Coast of Africa, mostly in wrought or manufactured wood, reference to statistics of which are given. Our author says :—"Here, as elsewhere, along this coast, American trade insinuates itself, whether in wooden gimcracks, furniture, rum or tobacco," and again, "A regular export, however, to West Africa of timber proceeds from the United States of America."

The work under notice is one of considerable interest in connection with forestry and the wood trade, as well as with other and kindred subjects, and is a welcome addition as a standard work to those particular branches of literature. We have no doubt it will meet with an active sale, and find a place in every library and collection of practical works bearing upon the trade and development of our colonies and dependencies.

We compliment the author upon his work, which must have been one of enormous labour and no little cost.—*Timber Trades Journal.*

---

THE GREAT NOVA SCOTIA RAFT.—When we last week again drew attention to the monster raft which left Nova Scotia on the 5th inst. for New York, we excused the brevity of our comments on the speculation till we knew whether or no the huge quantity of timber chained together would reach its destination or come to grief, as we had our apprehensions of the adventure being a risky one, and, as many expected, it has so far come to grief that it is adrift on the open ocean, entirely at the control of the elements. An easterly gale sprang up on Sunday, the 18th, and in latitude 40 deg. 16 min., long. 70, the tow line parted, and the raft was lost, and when last seen was drifting in a southerly direction.

In the accounts of the disaster yet to hand no mention is made of the steersman—or was there none? If so, the voyage must have been hopeless from the first, as in a contrary wind or a cross current it would be impossible to keep an elongated mass of material as this presented from coming athwart without something in the shape of a helm. The towing appears to have been set down as too easy a job, and it is evident proper provision was not made to meet one of the land gales, or rather hurricanes, which are so frequently encountered along the Atlantic coast.

If it was worth while to build a raft on such a gigantic scale, it was certainly false economy to put it under the management of one steamer. This vessel, called the *Miranda*, may have been of sufficient power to have towed the raft, but when the connection was severed by the parting of the tow line, all control was gone till the gale subsided, and the chance of clawing hold of this floating island of wood with seas running mountains high became no light undertaking. The catastrophe might have assumed a less serious form had two tugs been employed, as when one line parted there would have been the other holding on, affording time for the other to again lend her help.

We shall not be a bit surprised, however, to hear that the *Miranda* has again picked up the raft, which, of course, in fulfilment of her contract, she will go in search of directly the gale moderates. One would have thought that a prudent commander, as soon as his line parted, would have run down to leeward of the sea-washed mass, and there ridden out the storm in comparative comfort, the huge pile of timber forming a splendid breakwater.

In severe gales, where there is danger of a ship straining, it is not unusual for those in charge to get all the spare spars lashed together and launch them overboard, secure with a strong line, and allow the ship to drift to leeward, slacking up till the spars or raft is sufficiently far to windward to break the force of the sea.

We cannot understand why in the storm the *Miranda* continued to tow; she should have slacked up and saved the strain on her cables, keeping as near the raft as she safely could; but, of course, there may have been circumstances of which we know nothing that made it expedient for the steamer to look to her own safety, and, perhaps, after all, it was a case of abandoning the raft instead of the tow ropes parting. This view has some colouring in it from the fact that a United States man-of-war is said to have been sent in search of the "raft," but if the *Miranda* had not broken down we cannot see why she was not quite as capable of looking after the raft as any other vessel.

In 1792 a raft containing about 1,000 tons of timber was built at Swan Island, in the Kennebec, by Dr. Tupper, a somewhat noted eccentric character. It was made by tree-nailing square timber together in the form of a ship's hull, and was ship-rigged, the intention being to send her across to England. At that time no manufactured lumber was admitted to the ports of Great Britain; hence the timber in the raft was simply squared with the axe, to make it stow well. The ship or raft lay at Bath for some time, it being difficult to get men to go in her. She finally went to sea, however, carrying a small vessel on her deck. But off the Labrador coast her crew became frightened by bad weather and abandoned her. She was afterwards boarded by men from a passing vessel and found to be in good order, and it was suspected that she was deserted without sufficient cause. Two other similar attempts were made from the Kennebec, and both vessels went safely across, but foundered on the English coast, under the same suspicions of fraud as in the case of the Tupper ship. In 1825 the ship *Baron of Renfrew* was launched at Quebec, having made a previous unsuccessful attempt, when she stopped on her way, owing to the grease being consumed by fire from friction. She was towed down to the island of Orleans and anchored. Her dimensions are given as follows:—Length, 309 feet; breadth, 60 feet; depth, 38 internally and 57 externally; tonnage, 5,888 tons; draft when launched, 24 feet; cargo on board when launched, 4,000 tons of timber. She was ship-rigged, with four masts, and was perfectly flat bottom, with a keel of about 12 inches, wall sided, sharp forward and rather lean aft, and looked more like a block of

buildings than a ship. She sailed in August, 1825, drawing 36 feet of water, in command of a Scotchman, a half-pay lieutenant in the British navy. October 27th the *Baron of Renfrew* drove on shore on the coast of France, near Calais, and went to pieces.

It is evident there are too many contingencies attached to rafting timber across the ocean to make it probable that any such method of transport will ever become general even if this Nova Scotia raft ultimately reaches its destination.

For the information of those of our readers who may not have retained the particulars we gave of this extraordinary structure, we may mention that the raft consists of 27,000 trees, bound together by a series of chains which connect those around the outer edges with a larger central chain, running lengthwise along the mass. The shape of the raft resembled that of a cigar, its length being 560 feet, greatest diameter 65 feet, the weight of the raft being 11,000 tons. The total cost of the raft, including timber, construction, and transportation, is about $30,000. The raft has the capacity of 70 large schooners, and the usual freight charges alone for this amount of timber are $25,000. Two other rafts of the same size are now being built in Nova Scotia.

This mighty mass of timber, though estimated by some of our American contemporaries to be equal in weight and dimensions to the still "living," but not for long, wonder of the world, the *Great Eastern*, falls far short of the bulk and capacity of that Leviathan steamship, and we are well within the mark when we state that the big steam vessel could stow all the trees in the Nova Scotia raft and a score of big shiploads besides, her burden being 22,000 tons, and her length 700 feet, and breadth over all 87 feet. The raft, it will be observed, falls far short of this, and is a long way removed from exceeding the largest ship afloat, one of Her Majesty's ironclad fleet, the *Northumberland*, being over 12,000 tons, if we take the actual burden, which in comparing with a raft of solid timber it is only fair to do. Those who have been out at sea in bad weather will fully understand the magnitude of the task the shippers of this huge mass of timber undertook, and those who have invested in the venture will wait with bated breath the news which passing vessels which have sighted the floating mass will bring. To vessels ignorant of its composition the first sight will lead them to the conclusion that they must have got out of their reckoning, whilst some amongst the superstitious might think that they had met with the great sea serpent at last. It will not surprise us to hear some more legends of that great unknown animal conveyed to us by those whose glasses have been pointed in the

direction of the "raft," when the weather was misty or a gale blowing that gave them no opportunity of taking more than a flying look.—*Timber Trades Journal.*

---

UPPER BURMA FOREST LEASES.—While attention is being drawn to the settlement by the Government of India of the various claims brought by creditors of ex-King Theebaw, it may be well to recall the circumstances under which the Bombay Burma Trading Corporation, Limited, obtained the concessions referred to by Sir John Gorst in his reply to Dr. Hunter, as reported in the *Times* on the 5th instant.

This Company had for a series of years worked the principal forests under leases renewed from time to time. The earliest of those leases, of which any account must be taken, began in 1881, and expired in November 1884. According to the terms of this lease, the Corporation enjoyed the sole right of removing teak timber from the King's forests into foreign territory. The rates to be paid by the Corporation for such logs as had been cut and worked out by the King's own people are stated in the contract, as well as the royalties to be charged on the logs worked out by the Corporation itself. The schedules of rates include all possible sizes and qualities of logs, full-sized and under-sized, long and short; but apparently nothing under 12 cubits (18 feet) in length was bargained for.

A question arose as to the right of the Corporation to reject any timber under the terms of this lease, and to settle the dispute a supplementary contract was entered into in July 1882, to come into force in November, and to continue till November 1887, allowing the Corporation to cut and remove as many logs as they chose provided these measured under 18 feet in length (any girth), or were under 4½ feet in girth (any length).

Under this contract, called the "Shorts," a lump sum of Rs. 1,00,000 had to be paid annually by the Corporation. Now it is manifest from the wording of the original lease that the Corporation had no right to reject any logs on the ground of their being under 4½ feet in girth, and to those who know anything of the Burma teak trade it must seem surprising that payment for full-sized short logs (under 18 feet in length and over 4½ feet in girth) was not provided for at all. There is an unexplained mystery about this "Shorts" lease, for while the Corporation's agent, Mr. S. Jones, declared that it had been forced upon his firm, "in order to extract money," the Burmese held that under the original lease

there was no such thing as rejected timber. (*See* correspondence in Burma Blue Book).

It may not be possible now to discover at whose door lies the credit or the blame, but there can be no doubt that the omission from the first lease of short full-sized logs (*i.e.*, full-sized in girth), which led to the subsequent agreement, was a distinct advantage to the Corporation. Some of the largest and most valuable pieces of teak that reach Moulmein and Rangoon measure less than 18 feet in length, trees of large diameter having in many cases to be cut into short lengths to enable the elephants to drag them. Apart from those logs which the foresters are obliged to cut short, there must be a great temptation presented to the workers under such a lease to sacrifice a few inches in the length of "Hlaw" logs, on which a fixed royalty of Rs. 6-8 each was payable, in order to get them included in the "Shorts" contract. The complaint of Mr. Jones that this second contract was forced on them seems to indicate that the Bombay Burma Trading Corporation was obliged to agree to the terms in consequence of some other parties offering to compete with them for the working out of the large-sized short timber omitted from the first lease, and there was a report in Burma that such was really the case. A few months after the "Shorts" contract came into force, a third lease was arranged to take the place of the original one, expiring in October—November 1884. This too, like the second, was a lump sum contract, the amount payable annually being Rs. 3,50,000. When the quarrel arose between the Bombay Burma Trading Corporation and King Theebaw's Government, which resulted in the Burmese war, there were, therefore, two leases in force, which, for all intents and purposes, may be treated as one. Under this the Corporation had to pay yearly a sum of Rs. 4,50,000, and for that was allowed to cut and remove as many teak logs of any size as its foresters could.

All that has been said above refers to the Ningyan and Tounghoo forests, where the disputes arose. The Corporation, besides these, worked the Chindwin forests, and had agreed to pay for this concession from November 1887, a lump sum of Rs. 2,50,000 annually, so that for a yearly payment of Rs. 7,00,000 the Corporation claims under these leases to work all the principal teak forests in Upper Burma without let or hindrance until November 1892.

In deciding as to the claims of the Bombay Burma Trading Corporation, and as to the future working of the forests in Upper Burma, the Government of India has a most difficult task set be-

fore it. That this is felt to be the case by the authorities themselves may be gathered from the fact that the matter seems still to be under the consideration of Government.

As far back as November 1885, a memorial was addressed by Moulmein merchants and traders to the Chief Commissioner, and this was followed by one to Lord Dufferin when he visited Burma, early last year, signed by a large number of the leading firms in Rangoon, Moulmein, and various parts of India. In both of these the Government was strongly urged to abolish all existing leases and to place the working of the forests in the hands of the Forest Department, and it was suggested that any compensation found to be justly due to the leaseholders should take the form of a monetary payment. In the memorial to the Viceroy it was recommended that "the investigation into the claims of the leaseholders should be conducted openly by an influential commission of enquiry, with full powers to thoroughly sift all the evidence produced before it." Up to the present time no such investigation has been started, and there is a very general impression abroad in Burma that Government might find it somewhat inconvenient to carry through such an enquiry as the one proposed. We went to war because Theebaw insisted that his decree against the Corporation for breach of contract was not an arbitrary one, and refused to submit to the investigation proposed to him by the Viceroy.

What people on the spot, who are most deeply interested in the matter, want is just what Theebaw was deposed for refusing—a searching investigation into all the circumstances connected with the granting and working of the forest leases.

A letter published in the Burma Blue Book (1886), page 195, throws some light on the means adopted by the Corporation's agents to influence the Chief Commissioner on their behalf. The letter is attributed to Mr. Andreino, their Mandalay agent, but was evidently written by Mr. Louis Andrews, a German, and one of the Rangoon managers who had gone up to discuss matters with Mr. Andreino.

From this letter it is clear that the King's agent (at Rangoon) was a creature of Andreino's own making, and that his answer to Mr. Bernard's Secretary was a "diplomatic" answer put into his mouth to serve the purpose of the Kin Woon Minghee.

In the *Times* of the 13th July last it was reported from Calcutta that the Government of India had come to an arrangement with the Corporation, and that the leases were to be continued under fresh conditions. This may or may not be true, but if Government can take upon itself to vary the terms of Theebaw's

leases, why not go a little further and abolish them altogether? Nothing short of this will satisfy the other traders in teak.—TEAK.—*Timber Trades Journal.*

---

FLORAL BAROMETERS.—A remarkable little weather-wise plant is now said to be on exhibition at the Jubilee Flower Show just opened in Vienna. According to the account supplied by the proprietor of this natural curiosity it belongs to the family of the sensitive plants, but is so extremely meteorometric that it not only moves if touched, but will close its leaves forty-eight hours in advance of any change in the weather. It seems, moreover, to be the most catholic of barometers. For it foretells not only rain and wind, storms, and "set fair," but earthquakes and other subterranean movements.

There is, of course, nothing impossible in the assumption that a Mimosa has been discovered more sensitive than the species with which the world has so long been familiar. We are not aware that hitherto any of them have exhibited hygrometric qualities, though it is needless to remind the gardener that several well-known forms instantly fold up their leaves when touch is applied, and, on a tropical turf covered with them, will so rapidly transmit the movement to one another, that the pedestrian sees to his amazement a sort of wave of motion travelling ahead of him. For ages it has been an everyday piece of weather-wisdom that if the Siberian sow-thistle shuts at night the ensuing day will be fine, and that if it opens the sky will be overcast and the day rainy. If the common African marigold shuts at seven o'clock in the morning, there is a probability of rain being at hand. If the bindweed and the common marigold are already open, they will shut up at the approach of rain, while the pimpernel is so notoriously sensitive to any excess of moisture in the air that it has received the name of "the poor man's weather-glass." It is a familiar fact to students of vegetable physiology that the leaves of *Porleria hygrometrica* fold down or rise up in accordance with the state of the atmosphere. The leaves of the Hœdysarums have been well known, ever since the days of Linnæus, to suddenly begin to quiver, without any apparent cause, and just as suddenly to stop. Force cannot initiate the movement, though cold will stop it, and warmth will set in action again the suspended animation of the leaves. If artificially kept from moving, they will, when released, instantly begin their monotonous task anew, and, as if to make up for lost time, will dance with redoubled energy. The lower petal of some

orchids manifests similar spontaneous movements, the nature of which is more mysterious than the tendency of the compass plant of the Western prairies to present the edges of its leaves north and south, while their faces are turned east and west. The leaves of the *Colocasia esculenta*—the Tara of the Sandwich Islands—will often shiver at irregular times of the day and night, independently of the wind or any external cause which can be detected by our rude senses, and with such energy that little bells hung on the plant tinkle. These, and many similar cases of something akin in appearance to spasm or reflex action which will recur to the memory of a botanist, are not to be explained by the presence of any peculiarity in the structure of the plant, and even did an organism exist, the sensitiveness by which the motive organ is affected remains as mysterious as ever. Such a structure has been described in the sensitive plants—whose activity, it is also said, may be paralysed by the vapour of chloroform—but we believe the keenest eye has not as yet been able to detect in the species just named any similar peculiarity capable of accounting for these strange motions. The chances, therefore, are that they are due to changes in the weather of such a slight character that our nerves are incapable of appreciating them, or the mercury of recording their accompanying oscillations. It is, indeed, this extreme sensitiveness to atmospheric conditions, and more particularly to light, which causes certain plants to close, not only when there is a shower on hand, but at particular hours of the day. "Floral Clocks" can thus be made by planting flowers in a circle according to the well-ascertained times of their waking and going to sleep.—*Pioneer.*

---

THE

# INDIAN FORESTER.

**Vol. XIV.]** **August, 1888.** **[No. 8.**

## THE FORESTS OF MANIPUR.

(*Continued from page* 299).

To the south of the Cachar-Manipur road, in the forests that contain the India-rubber, the nagesar (*Messua ferrea*) abounds, and a small trade is done by the hill tribes in collecting its medicinal flower-buds. Along with nagesar one or two species of Eugenia are occasionally met with; and the járúl (*Lagerstrœmia Flos-reginæ*) is in great abundance, and with it the equally plentiful tún (*Cedrela Tuna*). These useful trees ought to furnish the planters of Cachar with a never-failing supply of admirable tea-box wood but for the difficulty of removal. I cannot enumerate all the bushes and herbs seen in these forests; ferns and dwarf palms form a dense under-vegetation, while every bough overhead carries its profusion of epiphytic orchids. In exposed situations the tropical Cassias abound—*C. Fistula* in the forests; and *C. occidentalis*, *C. Sophora*, and *C. Tora* forming gregarious clumps in the open jungle. The general tone of the vegetation recalls, in fact, the warm, damp forests of South-eastern Bengal, devoid only of the cocoa-nut, betel-nut and palmyra palms, while every now and then the appearance of strangers bespeaks the border-land of a perfectly distinct area, the Malayan—such, for example, as the many plants belonging to the *Melastomaceæ*, *Ternstrœmiaceæ*, and *Guttiferæ* natural orders. In the Kala Naga forests the wild elephant is also fairly plentiful, and the Manipurís sometimes combine and hunt for the precious ivory—a demand that is rapidly exterminating the monster of the forests from Southern Asia. Far away on the eastern side of Manipur recent foot-prints of a herd of elephants were met with, but practically the Manipur stock

is confined to the southern Jírí forests bordering on the Lushai country.

But I must hasten forward, as there are still some 70 miles to traverse before the valley of Manipur is reached. After having marched through some five or six miles of damp dense forest, the path improves with the ascent to the Godamghát outpost. Formerly about half-a-dozen Manipur soldiers used to be retained here; but owing to the unhealthiness of the station they were removed. After leaving Godamghát the last view is got of the Jírí river, and its dense evergreen forests stretching far to the left. A new country is entered on the ascent of the Múkrú range. The soil is dry and rich, and the forest changes completely its character. A few trees of nagesar continue, but soon become intermixed, in dank shady glades, with the graceful rounded clumps of the fig (*Ficus triloba*), the large leaves of which, with their ferruginous velvety surfaces, are truly lovely. On dry grassy slopes and on the more open forest tracts, another fig is met with (*Ficus conglobata*). This tree, throwing towards the ground its fruiting boughs succeeds, through the aid apparently of ants, in having its fruits completely covered with the loose rich soil in which they are ripened. On the boughs of this tree a curious bee was found which, ant-like, had constructed its hive by sewing two or three leaves together. The insect was very small, and had a curious greenish metallic lustre. Thinking this to be an ant that perhaps preyed upon the smaller species, supplied with food by the fig in return for services rendered, I was about to catch hold of it, when one of my coolies told me not to do so, as the bee stung very badly at first, but lost this power after a time. This local wisdom dictated a course of procedure that greatly astonished me. The hive was struck gently with a stick once or twice, the adventurer rushing off as hard as he could between each attack. By-and-bye, deeming that the bees had got over their fit of ill nature, he coolly went up and cut the hive off the tree—the bees crawling over his hands all the time without stinging him.

In the forest above, the Mukru (*Schima Wallichii*) makes its appearance—a tree 30 to 60 feet in height, which when in full flower, looks remarkably like a tea tree. It is indeed a closely allied plant to the Camellia; and along with *Sauravja Roxburghii*, observed lower down, may be viewed as establishing the Ternstrœmiaceous character of the Manipur forest, which becomes more and more pronounced, until in the eastern ranges, forests of the true tea plant are met with. *Schima Wallichii* is an extremely variable plant, and a well-marked form of it (*S. Noronhæ*, Reinw.)

fully deserves, in my opinion, the independent position once assigned to it. This form may be said to make its appearance in Northern Assam and the Khasia hills, and to spread east and south through Manipur to Northern Burma, and thence to Penang, Borneo, and Sumatra. It may readily be distinguished by its thicker, more coriaceous leaves, shining green above, felted canescent or shortly tomentose below, with the midrib hairy. Venation quite obscured, margin more or less crenate or sometimes almost quite entire. Flowers less than one inch in diameter. I would refer to this type *Gordonia mollis*, Wall., *G. floribunda*, Wall., *Schima mollis*, Dyer, and *S. oblata*, Kurz; but I would place *Gordonia oblata*, Roxb. under *Schima crenata*, Korth., a Malayan species. In part confirmation of this re-arrangement, there exists on Roxburgh's original drawing of *G. oblata*, a note to the effect that the specimen figured by him was obtained from Penang. Few genera have species blending into each other more completely than do those of *Schima*. If *S. crenata* be not retained as distinct, then *it*, together with *S. Noronhæ*, must be thrown into an artificial species, which might perhaps bear the name of *S. Wallichii*. To the north a still more marked variety of *S. Wallichii* (or rather of *S. Noronhæ*) was found, which perhaps deserves specific recognition. The shape, texture and venation of the leaves of this plant closely resemble those of Anneslea. The obsolete reticulations, through the succulent texture of the leaves of this plant, and of those of the form recognised as *S. Noronhæ*, at once separate the living plants of these forms from *S. Wallichii* on the one hand and *S. khasiana* on the other. As seen in the forests these trees are quite distinct, but it is scarcely possible to speak of them, as found in the herbarium, with the same degree of certainty. I was greatly astonished to find at a height of 2,000 to 3,000 feet in the Múkrú forest, a species of screw pine, probably *Pandanus furcatus*. This elegant plant was seen to raise its crown of spiny leaves on a long, delicate, erect stem, which gracefully curved in its efforts to carry its head above the dense under vegetation. Beneath, the pandanus a species of Tapistra (which I have in my diary named *T. Bakeriana*) made its appearance, and continued from the Múkrú forests throughout Manipur in all the forests above 4,000 feet in altitude. This is in fact the most abundant Liliaceous plant in the State.

Descending the Múkrú range to the east, the river of that name is reached which is seen to flow in a southerly direction. This is a large clear stream of perhaps 40 yards in breadth. *Mahsír* fish were observed moving sleepily about in its deep pools, but refused either spoon or any other tackle. A rich harvest was, however

made in butterflies. These swarmed in myriads, especially four or five species of swallow-tails. A white butterfly was seen in great profusion, but always flying down the stream in lines perhaps 40 or 50 deep, following one after the other in so compact a manner that an expert swing of the net would often secure the whole string. On ascending the opposite slopes these curious insects were noted to be flying up the valley singly, fluttering here and there from flower to flower, as they worked their way up the gorge, to rush down the stream again in detachments apparently in a playful manner.

A volume might be written on the herbs and shrubs collected in this deep dark gorge. Ferns were in great abundance, and a species of Piper mingled its deep green ternately-veined leaves on the rocks with the leaves (also ternate-veined) of herbaceous and bushy melastomaceous plants—*Sonerila tenera*, Roxb., *S. maculata*, Roxb. and *Sarcopyramis nepalensis*, Wall. With the ascent from the Múkrú, the task of climbing the Kala Naga range practically commences. The forest and jungle is at first dense, but gradually becomes open, until the clearances around villages are reached. Studded here and there along this range are the village sites of the Koupuí Nagas, an extremely primitive race of people, who have been gradually expelled from their ancestral homes, to their present haunts, by the invasions of the Kukís from the country to the south. From the summit of the Kala Naga range a magnificent view is obtained of the country around. Far away to the west are seen the plains of Cachar, with the great Barak river winding among the hilly knolls that have been appropriated by the tea-planter. At the visitor's feet in the deep gorge below runs the sullen stream of the Múkrú, and stretching away beyond are the dark evergreen forests of the Jírí. East the eye wanders over a series of mountain ranges which enclose the Irang river, and which rise higher and higher until they culminate in the Limatol range, which overlooks the valley of Manipur, some 25 miles distant.

Continuing the road a descent is made to the upper reaches of the Barak, a stream fully 60 yards wide, stocked with fish, and having all the appearance of being likely to prove a rich field for the angler. Opening every now and then into deep pools, it is broken by gentle rapids, while the forest trees and bamboos throw the desired degree of shade without impeding the operations of the sportsman. From the Barak the path again ascends, and for a time skirts along the Irang river, where one or two charming bits of forest and wild rocky scenery occur, with refreshing water-

falls rushing below the traveller's feet. By the bed of one of these rivulets the rocks were found clothed with clumps of a beautiful Colocasia, the dark variegated foliage of which recalled the gardener's efforts with the allied genus Caladium.

To a large extent the forests over the regions rapidly sketched consist of *Schima* and *Saurauja* trees—the former with their single camellia-like white blossoms contrasting elegantly with the wax-like pink flowers of the *Saurauja* bushes. Several of these *Saurаujas* have large beautiful leaves densely matted with a russet tomentum, and having a profusion of veins that recall the *Dillenias* of the lower forests, while in their clump-like habit they equally bring to mind the rhododendron forests of the higher regions. A species of *Eriobotrya*, probably *E. petiolata*, Hook. f., was very plentiful. *Hyptianthera stricta*, W. and A. (of the form named *angustifolia*) was also common, and along with this another Rubiaceous plant, *Adenosacme longifolia*, Wall. Of the last mentioned plant there are three readily recognisable forms. One which I have called the *type* has leaves acuminate and flowers few not dichotomously cymose; the second, *tomentosa*, is a distinct form with cordate leaves, the whole plant coarsely hairy and the calyx teeth glandular; the third form—*dichotoma*—is distinguished by a large and pronounced dichotomous inflorescence. In the darker parts of the forest the stunted bush, *Acranthera tomentosa*, Br., with its clusters of large rose-pink flowers was gathered—a plant discovered by Griffith in the Mishmi hills, and said to be found also on the Khasias. It is plentiful in the forests between the Barak and the Irang, and is without exception the most handsome plant in Manipur, and one well worthy of introduction into European cultivation. It is only about a foot-and-a-half high, has four or five large leaves about 8 or 10 inches long, with (hid below its graceful foliage) pendulous clusters of some 20 rose-pink flowers, each flower fully 2 inches in length. Along with this elegant plant were also gathered *Ophiorrhiza lurida*, Hook., *Saprosma ternatum*, Hook., *Wendlandia exserta*, DC., and *W. glabrata*, DC., all members of the family, *Rubiaceæ*, and all fairly plentiful and giving a new character to the under vegetation. Between the Barak and the Irang the road dips down into the valley of the Lengba, where *Schima Wallichii* is met with in great abundance, along with the *Scrophulariaceous* large tree *Wightia gigantea*, Wall., an uncommon plant found in the Central and Western Himalayas, Sikkim and Bhutan, and distributed to Java. A remarkable Sikkim type of vegetation gets more and more developed as the traveller wanders northwards along the western ranges of Manipur; and the appearance of so

striking a tree may be viewed as the most southern indication of this feature of the flora. But gradually the Sikkim type becomes established with the occurrence on the heights above the Irang, of *Aucuba himalaica*, a bush, which prior to my visit to Manipur, was supposed to be confined to Sikkim and Bhutan, and to be distributed to Japan. Manipur fills up the connecting link; for everywhere from the Limatol range at 4,000 feet to Sarameti at 10,000 feet, this large bush occurs bearing a north-easterly direction through the State.

From the Longba the road works its way through the forests that skirt the western wall of the Irang basin, and having crossed this and descended to the bed of the river, it ascends the opposite side, until it reaches the cup-shaped valley of the Kowpóm. This may be described as the first of the extensive series of valleys into which every now and then Manipur expands. Kowpóm is in the rains a rice swamp of fertile soil, about 2,700 feet above the sea. In the winter, however, the temperature falls so low that ice forms on its marshes. On leaving this smiling valley the road skirts the northern side, and makes the ascent of the ridges which separate Kowpóm from the valley of the Limítak, a tributary stream of no great importance. From the presence of a species of *Castanopsis*,* resembling an oak, these hills are generally called Pemberton's oak ranges. The oaks proper form a feature of the eastern and northern division of Manipur, but so far as I was able to judge, do not occur on the western outer ranges, although they are met with on the slopes of the Limatol facing the valley of Manipur, especially to the north. From the Limítak the road winds up the ascent of the last and loftiest range of the western division of Manipur, *viz.*, the Limatol; and as it passes the crest of the ridge, it is 4,900 feet in altitude. From this point a magnificent view of the great valley of Manipur is obtained, with its expanse of water to the south, the Lotak lake, and its forest to the north—the site of Impail the capital of the State.

*(To be continued).*

## ANNUAL MEETING OF THE AMERICAN FORESTRY CONGRESS.

### First Day's Proceedings.

PROMPTLY at 10 o'clock in the morning President George W. Minier, of Illinois, called to order the sixth annual meeting of the American Forestry Congress. Considering the usual meagre at-

tendance on the opening days of all associations, a good representation was present, delegates appearing from all the principal States of the Union—from the Atlantic coast to the far west. Among those of prominence present were :—B. E. Fernow, of the National Department of Agriculture, Washington, D. C.; Leo Weltz, Commissioner, Ohio State Board of Forestry, Wilmington, O.; George W. Minier, President American Forestry Congress, and many others.

In opening the session President Minier stated briefly the objects of the Congress and gave a few events of its history since the first annual meeting six years ago. Although, first an organization of the United States alone, it had been broadened to embrace in reality the whole western hemisphere, and the name changed to the "American Congress of Forestry." While this action had been wise in some respects, it had had its disadvantages, as making the Congress international in its character apparently, precluded the hope of obtaining appropriations to defray its expenses, from either the United States or any other American Government.

On motion of B. E. Fernow it was decided that the papers of certain members absent and unable to be present be read and discussed.

"Area and Economic Value of the Forests of the United States," a very able paper by H. C. Putnam of Eau Claire, Wis., was read by the Secretary. Mr. Putnam, having had over thirty years' experience in the lumber and timber business, his views were considered of unusual importance by the Congress. The lumber men of the north-west, he said, were cutting the pine forests of that region at the rate of 800,000,000 feet a year. Fifteen years will see the great pine forests of Wisconsin obliterated as an article of commerce. Just so with the forests of Michigan, Minnesota and the whole north-west. The importance of legislation on this subject cannot be over-estimated. Care should be taken against the origination of the devastating forest fires. Officers should be appointed by the National or State Governments to look to this and see that the laws already in existence are enforced. The young trees should be protected in their growth where the larger are felled and cut up. It is easier to save a thousand young trees than to plant and nurture one. By proper care and discrimination, by proper legislation, these great forests can be preserved at their present acreage. But will the National Government or the States ever move? The slaughter goes unheeded onward year after year. If these forests are destroyed, the great rivers of the

north-west will in the dry season become less than babbling brooks instead of commercial waterways as they now are. History has proven this prophecy to be inevitable. As a nation we are rich in forest area. The 800 miles of coast of the Carolinas, Georgia, Florida, Alabama, Mississippi and Texas, extending inward an average of 100 miles, carries a valuable pine forest of both varieties. Just so with other portions of the country. Australia, China, Japan and the islands of the sea, on the other hand, have no timber of commercial value. Mexico has some, but at present it is almost inaccessible. Europe depends entirely upon us for many varieties of timber. Are we to be profligate of these great riches, or are we to lavish and destroy? Action by Congress, and laws to insure preservation of the growing timber are the only safeguards. But we must not wait too long.

*Discussion.*

Mr. Fernow opened the discussion on this paper. He thought the incentive to forestry legislation lay rather with State legislatures than with the National Congress. In Michigan a commission has already been appointed to suggest legislation in that direction. Other States should follow. In Canada the most encouragement had been received. There the proceedings of this Congress were printed without the inquiry being made whether the organization were Canadian or American. There the Government has conjointly with the timber men appointed "fire wardens," to look to the preservation of the forests from fires and secure enforcement of all the laws. The lumber men pay half his salary and the Government the other half. This man has the power of police officers. He can make arrests and in case of emergency can summon all citizens to his aid in the suppression of fire or enforcement of the law. In Michigan, alone, on the other hand, the forest fires have done a damage of over seven million dollars. Of course the States could do nothing in regard to the mountain regions and Government reservation. Congress would have to legislate on that subject. The manner in which the Government forests were devastated was shameful, yet laws should not be passed without the instrument to enforce them. A national commission or board should be appointed with the necessary powers. The present trouble was that, although in most States laws already existed for the protection of forests against fires, there were no commission or officers to look after their enforcement.

Prof. J. L. Budd remarked that he had been surprised when in Riga, Russia, some years ago to find that shiploads of pine were

being continually shipped from that point to the United States in large quantities. On the other hand the English have picked up nearly every black walnut log in the west and shipped it to England to be manufactured there. Speaking a little off the subject he wished to state right here for general information that in Iowa they had found that white pine was one of the best timbers to grow. Groves planted 18 years ago were now from 40 to 50 feet in height. No particular experiments had been made with red pine, but they seemed to flourish wherever planted and proved very ornamental. Observations made by the Iowa people had shown that white pine made the best growth of any tree in the State. Red pine probably came next, and it was followed by white spruce.

"Helps and Hindrances to Kansas Forestry," by W. S. Newlon, of Oswego, Kan., was the next paper read. The author stated that the people of Kansas in years gone by had done a great deal of grove and tree planting on their farms and around their orchards, fields and homes. These benevolent efforts were now giving a rich return. All that was needed in the future was intelligent discussion and agitation to stimulate in the mind of the masses a benevolent inspiration for forestry. The hindrances to forestry in Kansas were the great droughts, fires, birds and insects, and the consumption of the timber as rapidly as it grew. In the past the prairies of Kansas were burned annually and much timber destroyed in the course. In Indian territory particularly these fires still ravaged periodically. To prevent the frequent disastrous fires from railroad sparks, the funnels of the locomotives should be netted. Much timber too is needlessly squandered in Kansas in the construction of bridges and other public structures that should be composed entirely of stone. Wire fences, too, should be built rather than plank ones. A substitute for wood in railroad ties should also be adopted by the railroads. The demand for ties probably makes a greater inroad on our forests than any other one article. The laws of Kansas fail to protect certain birds from indescriminate slaughter because of the impression that they eat and peck fruit and perforate trees. While this to some extent is true, yet these same birds do incalculable good by preying on borers and other insects that attack the trees. A law of Kansas forbidding the growth of hedges to a height of over 4½ feet was also an unwise act. They should be allowed full scope. The roots of trees and herbage stop the circulation of water through the ground, and hold it from running off and away through the streams too rapidly. It is a well-known fact to close observers that fibrous roots hold water

like a sponge and will make a swamp anywhere. This fact materially affects the rainfall of a country. Trees by consuming effete carbonic acid and giving out oxygen are valuable as preventives of malaria and other diseases. As a matter of fact birds are indispensable to forestry. Without them all trees would be destroyed by the various insects. Despite them many trees in Kansas are destroyed by the borers, caterpillars, grass-hoppers, aphis and other pests. The English sparrow and other birds destroy all these insects. The birds should be appreciated and protected from injury.

*Discussion.*

Mr. Minier said he endorsed every word of the paper—particularly all that referred to birds. They were his particular pets.

Mr. Fernow said he was astonished to see so few birds, comparatively, in the United States. The woods of North America appear lifeless compared with the woods of Europe. Singing birds particularly are scarce here.

Mr. Brown thought there were plenty of birds here, but they rather frequented the prairie groves and prairies.

Mr. Allen did not agree with the paper on the assertion that the roots of trees stored up moisture. That was, he thought, a great fallacy. He believed, on the other hand, the roots afforded an exit of moisture from the ground by sucking it up in the tree from whence it passed through the limbs and foliage to the atmosphere. Some of the birds, too, which the paper praised, he found in Western Kansas to be a great pest, sticking their bills into fruit and creating great injury.

Mr Morgan, of Ontario, Canada, in reply to this, said there could be no roses without their thorns. The birds paid for all their damage. He thought, however, roots were a great preservative of moisture. *They act as a sponge. Go several days after a heavy* rain and take a network of the roots and you can squeeze water out of them.

Mr. Osborne thought it wonderful the amount of moisture trees draw up through their roots and distribute to the atmosphere—even where the soil is apparently dry. Experiments have proven that the roots penetrate to such a depth as to obtain plenty of moisture where there has been no rain for months. In Nebraska he found the planting of forests had attracted the birds.

Mr. Fernow said that experiments so far had given no direct knowledge in regard to the transpiration of water by means of the roots and branches of trees. It is certainly true that the amount

of evaporation through the roots and leaves is enormous, yet it should be borne in mind that the roots, penetrating a distance often of 20 feet or more, bring up the moisture that otherwise would never be available.

Mr. Budd said that a few years ago, in the Adirondacks, he walked through a forest in dry mid-summer where the moisture actually wet his feet. Afterwards he visited the same country; the forest was cleared away, and where once was moisture was now arid desert. The point lay in the fact that evaporation from open land was much more rapid than from the earth covered with forests. Scattering trees did not do so much proportionate good in this respect as several thousand acres, as forest conditions seemed to be necessary.

Mr. Fernow stated that in Prussia, where forestry was better understood, and an annual crop of timber felled the same as any other crop, great trouble was lately experienced in disposing of the supply, timber being imported in large quantities from Gallicia and Hungary. As to the metal railroad ties suggested in the paper, Mr. Fernow would say that the Mexican railways had this year laid 60,000 of them as substitutes for wooden ones.

Mr. Budd said no climate on earth had been so greatly modified within 50 years as the climate of this part of North America. The clearing of the forests has clearly had much to do in this direction. Let us cultivate timber on our own soil, and not bring it from British America or Russia.

Mr. Fernow agreed that the clearing of forests greatly affected the climate. Experiments had proven that the temperature of forests was 15° to 20° lower than the fields in summer. In fall and winter the difference was somewhat less. The humidity of the forests was from 3 to 10 and even 13 per cent. greater than in open air.

Mr. Minier stated that years ago, when surveying the Illinois Central railroad and the Illinois river, he made some observations regarding the rainfall. A single inch of rainfall on a single acre of ground amounted to 101 tons of water! He also insisted that fibrous roots, acting as sponges, absorb large quantities of water. It is also true that an enormous evaporation is constantly going on through this medium. There is considerable moisture in the atmosphere all the time—so much, indeed, that if all the water above us for 40 or 50 miles could be condensed at once there would no longer be any dispute about there once having been a flood. [Laughter.] Regarding the subject of metal ties, President Blackstone, of the Chicago and Alton railroad, had informed the speaker

that they proved too great an injury to the rolling stock to ever be adopted. Paper ties were the only substitute, Mr. Blackstone has asserted, and it required bass-wood or linden trees to make them. "As to the birds, there are but few of them that are not our particular friends. In April, May and June they prey on the insects that attack the trees. In July and August they ask a little compensation for labor, and I propose to plant enough that they may come and get their pay without any trouble." [Applause.]

The report of the "New England committee" was read by the Secretary. It stated that the efforts of the committee had been principally directed toward securing legislation for the prevention of forest fires. The State grange of Maine had seconded the efforts of the committee, and in that, as well as other New England States, the results had been encouraging. In Maine a bill had been passed establishing an "Arbor Day" for the general planting of trees.

The report of the "Arbor Day committee" was read in the shape of a letter from Prof. Northrup. In all States visited, he had met with flattering results, many of them having already passed a law creating an "arbor day."

"Forestry in Nebraska" was the subject of a letter of the Nebraska delegates. It stated that great efforts were being made to awaken the interest of the people of that State in forestry with partial success. Already the forests at the mountain sources of the great rivers of Nebraska were being cleared off to such an extent as to endanger irrigation of Nebraska lands and, unless decisive steps were taken, in a few years the North Platte and other important streams would, in mid-summer, dwindle to feeble brooks or become entirely dry. The State Agricultural and Horticultural Societies, too, were urging the passage of a law by the State establishing "forestry stations"—that is, the planting at certain distances apart of considerable groves to be preserved intact. The delegates were endeavouring to secure the adoption of forestry as a regular course of instruction in the schools.

Mr. Budd thought every agricultural college in the United States, particularly, should teach forestry, and Mr. Minier amended the sentiment by insisting that every common school also should give limited instruction on the subject.

Ex-senator Gillham, of Alton, spoke at length on the necessity of forestry organization in Illinois. In his part of the State many trees had been planted, and the result had been satisfactory. He urged the adoption of resolutions by the Congress requesting the various States to amend their laws and constitutions in such a way

as to exempt from taxation all lands planted in forests for a given time.

"Legislation necessary for the encouragement of Tree Planting in Illinois," was the subject of a paper by Fred. Grundy, of Illinois, which was read by the Secretary. The paper was very brief, and particularly urged the passage of legislative enactments to promote forest planting. It concluded with the draft of a bill which the author thought should be presented to the next legislature of Illinois. This bill provided that land upon which a certain number of trees were planted for timber culture should be exempt for a limited time from all taxation.

Senator Gillham stated at the conclusion of the paper that a bill similar to the one presented had been introduced by him in a former legislature, but had failed to pass on account of its unconstitutionality, the constitution of Illinois providing nothing but school and church property shall be exempt from taxation.

(*To be continued*).

## PENSIONS AND FURLOUGH ALLOWANCES FOR THE UNCOVENANTED SERVICE.

We have read the debate in the House of Commons on Mr. King's motion "That it is inequitable and anomalous that privileges as regards leave and retirement should be refused to some classes of officers in the Uncovenanted Civil Service of India, which are enjoyed by others in similar circumstances; and that in view of the heavy fall in the value of the Rupee, the payment of pensions of retired European Uncovenanted officers in England at the official rate of exchange is no longer equitable," and we offer a few remarks on the debate as regards our own Department.

Mr. King made a most forcible and eloquent speech explaining that the present Uncovenanted Service of India has absorbed to itself several of the most important Departments of the Indian Administration, and that the leave rules and payments of furlough and pension in Rupees, however applicable they might have been in the early days of the service, when it was confined to "the Native peons who swept out the offices, and the junior clerks who copied letters and totalled up the figures of the Covenanted Civilians," were now completely inadequate.

There can be no doubt that hundreds of officers have been induced to enter the Public Works, Telegraph, Forest and Educational Departments in the hope that, after having devoted the best years of their life to the service of India, they might spend

their remaining years at home on a fixed sterling pension, as in the advertisements of Government for candidates for these services, the Rupee was referred to as equivalent to 2*s.*, and no one could possibly have foretold, 10 or 15 years ago, that it would only be worth 1*s.* 4*d.*, or even less. If Government wants the best English labour, it must pay English prices, and settle the question on an English basis.

Mr. King put the case very forcibly at the end of his speech, describing the pensioner as "watching the exchange rate with fear and trembling, moving from one house to another smaller one, giving up luxury after luxury, though to most of us they seem necessities, and one economy after another made, with a constant struggle to keep up the small insurance premium, by which alone his family can be kept from grovelling poverty."

Colonel Hill, who seconded the motion, spoke chiefly on behalf of Engineers, and explained that pension is merely deferred pay, and that salaries were fixed on a lower scale than they would be, if men had to make a future provision for themselves out of their salaries.

Sir J. Gorst cannot be said to have replied fairly to the arguments brought forward in favour of the motion. When he stated that in the Land Revenue and Judicial branch of the Uncovenanted Service, there were 139 Europeans only and 2,449 Natives of India, he omitted to mention that this branch is really intended by Government for Natives of India, and that in the Public Works, Telegraph, Educational and Forest Departments, by far the majority of the gazetted officers are Europeans, many of whom have been specially trained at home, and appointed by the Secretary of State.

When Sir J. Gorst endeavours to make this a matter as between Natives and Europeans, we entirely differ from him.

*Those Natives of India, who pass into the services in England*, and who might perhaps wish to settle in Europe after their services have expired, should receive sterling pensions, as well as Europeans, but those Natives who are appointed in India can have nothing whatever to do with sterling pensions. Several Natives of India are in the Covenanted Civil Service, and they will, we presume, receive pensions in sterling and not in Rupees.

It is clearly to the interest of India, that Europeans should not be encouraged to settle there after retirement with their families, adding to the number of claimants for posts, which should be chiefly held by Natives, but this is the direct result of inadequate pensions, as any one visiting our hill stations must at once recognize.

Sir J. Gorst spoke of the Covenanted Service, as recruited by competition at home, and stated that the Uncovenanted Service is mainly recruited without competition in India, omitting all mention of the home competition for the scientific departments of the Uncovenanted Service, and their expensive special education, costing from £600 to £900, after securing nominations, and before they can join their appointments in India.

Sir J. Gorst, in his reply, twice threatened the Services that any attempt to extend their privileges, might give rise to such action as might result in the distinction between Europeans and Natives being swept away, and admitting that the Public Works and Telegraph Departments had received exceptional favours, he was afraid that any further agitation would lead to levelling down.

This argument cannot prevent our urging our claims on the consideration of Government, the question as regards the present being chiefly one of justice to old servants, whose prospects of a comfortable retirement are blighted by the rate of exchange, and for the future, whether capable and energetic European officers can be tempted to India, if offered merely the same leave and pension allowances as to Natives of the country, whose homes are there. Those who consider that they have not been fairly treated, and heads of departments who wish to maintain their efficiency, will not be influenced by any such threats, in expressing their opinions on this subject.

In referring to the Native members of the Covenanted Service appointed in India, Sir J. Gorst omitted all mention of the fact that they draw only two-thirds of the salary of those appointed at home, and yet, when it is proposed to pay sterling pensions to hard-worked deserving European officers, he stigmatised it as an anomaly. Another fallacy of the Under Secretary of State's was that, in India the proportion of the pension to the pay was one-half higher than in almost any country in the world, and this, when Rs. 5,000 is paid as our maximum pension, except in certain favored cases, although the monthly pay of retiring officers may be Rs. 1,500 and more.

In the case of the writer, furlough taken after 16 years' service would be annually Rs. 6,000, or £400 at the present rate of exchange, whilst pension would only be Rs. 5,000, or, unless the rupee should be further depreciated, £333, out of which family pension fund and insurance, amounting to £100, have to be paid, leaving £233 as the reward of 26 years' of untiring service in India, when he retires after completing his 55th year.

During the debate, Mr. Courtney demurred to the Chancellor

of the Exchequer's admission that Uncovenanted Civil Servants suffered *great hardship* by the fall of the Rupee. He said that the purchasing power of the sovereign had increased, and that £400 would now purchase as much of the commodities of life as £500 did 20 years ago, so that although the man who was entitled to a pension of Rs. 5,000 would now only receive £400 instead of £500, he had nothing to complain of.

Now in the first place Rs. 5,000 at 1*s.* 4*d.* in the Rupee is £333 and not £400, and does Mr. Courtney mean to assert that school, doctor's and butcher's bills, rent, rates and taxes at home have gone down by £166 in every £500, or 33 per cent. in the last 20 years; if so, many of our officers would not defer taking furlough for 15 to 20 years, as is now frequently done, merely for want of means.

Some carefully worked up figures on home expenditure in these respects would be very interesting, and we doubt very much whether they would confirm Mr. Courtney's assertion.

Sir R. Lethbridge threw light on the question by explaining that there are many important posts in India, which cannot be filled by Natives of the country, nor by Covenanted Civilians. These are chiefly in the four departments we have already mentioned, and to which the country owes nearly as much of its progress, as to the Covenanted Civil Service. Now, as the Government of India considers sterling home allowances as absolutely necessary for its Covenanted Civilians, its Military and Medical officers and Chaplains, it seems very invidious that it should refuse such allowances to its Engineers, Educational, Telegraph and Forest officers.

Government has recently promised sterling pensions to the Lady Nurses just recruited from home, whilst it gives pensions in Rupees to men like Sir D. Brandis, Sir Leppoc Capel, Sir Alfred Croft and Sir Guilford Molesworth.

We have seen it stated that there is no hardship in our reduced pensions, as the Covenanted Service pay 4 per cent. of their salaries towards their pensions, while we do not contribute a Rupee towards our pensions.

It should, however, be remembered that these officers get £600 directly from the State, and only contribute towards £400 of their pensions, and that our salaries are not high enough to make our contributions towards pension sufficient to add more than say £100, which indeed all members of the Services would probably gladly agree to do.

The rate of exchange does not affect the amount of this contribution of the Covenanted Civilians, as they continue to pay the

same proportion of their pay now that the Rupee is at 1*s*. 4*d*., as they did when it was at 2*s*., and still get the exact sum of £400 added to their pensions.

We regret that Sir G. Campbell, Sir Richard Temple, and Sir G. O. Trevelyan, all of whom know well enough how matters stand with our services, should not have offered any explanation to the House, but should each have given a silent vote against Mr. King's motion, although they must know that public meetings of the members of the Uncovenanted Service would not have been held in all the principal towns in India without there being a real grievance demanding enquiry.

We maintain that as long as the Government of India finds it necessary to recruit men of European training for its scientific services, so long it will find its interest in encouraging furlough at regular intervals, by sterling home allowances, and early retirement, after a man has spent his best years in India, and that unless it can offer reasonable prospects of such indulgences, it had better cease recruiting in Europe, and content itself entirely with Native talent, as this will be better than that of the inferior Europeans, who may be tempted to come out to India, as soon as the determination of Government to refuse sterling home allowances is thoroughly understood in England.

The Ceylon Government has recently conceded pensions to its officers at rates of exchange which prevailed when each officer entered the service. This plan, although it might satisfy some of our older members, would be unfair to the future of our services, which demand sterling pensions of some definite value.

## RECORDING RESULTS OF PROTECTION OF FORESTS FROM FIRE.

It is now more than two years since the Government of India published the Tables illustrating progress in Fire Protection, prepared by Mr. Whittall, then Assistant Inspector General. In the end of the third paragraph of letter No. 94 of 19th February, 1886, the Inspector General in forwarding these Tables for the Central Provinces, remarks on the method by which the figures in the "Accepted" columns have been arrived at. "There are many and serious objections to it, and it is only adopted tentatively, in the hope that some one will arrive at a method of more accurately gauging the real benefit done to a forest by continuously successful fire protection."

As yet apparently no one has made any suggestions which have

been considered sufficiently practical to be accepted, and as I feel sure the subject has not been neglected by my brother officers, I put forward propositions for a different system of calculating the areas in the "Accepted" column with much diffidence.

In the same paragraph the Inspector General says—"It is hopeless to allow credit for areas protected for many years and then burnt"; and then again: "it is much the best to reject altogether than to attempt to allow credit." Now herein I, with all due deference, disagree from our chief. It must be remembered that year by year makes us more acquainted with the conditions of our forests, and thus we progress, slowly it is true, but still progress towards a knowledge of the damage done by fires. And I think that in the case of a fire, credit might be allowed to a fairly accurate amount if the state of things in a block is known. I would base the amount of credit to be given on the age of the oldest trees destroyed by the fire. The credit would of course vary with each block, and there would have to be some record kept of the number of years' protection to be struck entirely out in each block. I admit that this method is arbitrary and not quite exact, but why I recommend it is that it is better than excluding all areas burnt from the benefits of protection from the very beginning. This latter system *we know* is wrong. For instance, a fire occurred in the Garhakota block in 1883-84, spreading over 127 acres, the reserve having been protected (with the exception of a fire of 5 acres in 1881-82) since 1874-75. It stands to reason that the good done by keeping out fire for nine years cannot be swept away by a fire in the tenth. I therefore maintain that any system by which some effort is made to gauge the benefit derived from protection is better than the admittedly bad one of wiping everything out on occurrence of a fire.

I give the following details to illustrate my proposed method. In my division I have two blocks, Taroba and Bhimaram, the conditions of which as regards soil, vegetation, topography, in fact everything, are as different as they can well be. The former is situated on a block of stony hills with extremely poor soil. The dominant species is bamboo, and the tree growth poor both in quality and species. There is much very high grass, and the amount of combustible matter, such as dry grass, dead bamboos, fallen trees, &c., is very great. A fire in this block means terrible damage done to the standing stock, as we have very painfully experienced. Last year a fire ravaged the greater part of the tract, and the sight of the raging flames, the burning clumps of bamboos, the dead trees throwing up columns of fire was quite enough to convince

one that here at any rate most of the good done by previous protection was being made of no account, and that seedlings, which had sprung up under the care of successful protection, must have been destroyed, entirely or partially, up to a comparatively advanced age. Bhimaram, however, presents entirely different features. Better soil, climate more adapted to rich growth, and perhaps more complete success in protection, has resulted in a tree growth so dense as to have killed off the grass in the greater part of the block. Here if such an untoward calamity as a fire were to occur, I do not think it would do much damage, and in parts I doubt whether a two year old seedling would feel the effect of the flames.

I would, therefore, in fixing the number of year's protection to be struck off in case of a fire, put it very high in Taroba and very low in Bhimaram. The method would be arbitrary, I admit, but it would be nearer the truth than the present one. Presumably every Divisional officer inspects the site of a fire as soon after its occurrence as possible, and he could by experiment and close examination come to a fair idea of up to what age the standing growth had been really damaged, and this might be taken as the number of years for which all benefits from protection should be struck out.

Possibly—nay certainly—this period would have to be changed as successful protection fills up gaps, reduces the amount of grass, and generally renders the forest liable to less damage through fire. This of course could be done as necessity arose, and in all cases where the number of years had been fixed a long time previous, the amount of damage to be recorded would only be decided on after a careful examination of the forest.

This gauging of the benefit from fire protection and damage by fire is a subject of great importance, and even if my letter only results in obtaining the opinions of other officers, and my suggestions are put aside as impracticable, good will have been done.

CHANDA, C. P., G. H. FOSTER.
*3rd July, 1888.*

## COMPOUNDING FOREST OFFENCES.

I HASTEN to reply to "Single S.'s" letter on the above subject in the order as it is written.

*To answer his first question. My division contains 3,463 square* miles of Government forest alone, and I have to maintain a certain amount of supervision over private forests of an equal, if not greater, area. I find that a straight line drawn from the north-

west corner of my district to that in the south-east is 216 miles long. No—the Ranger is not empowered to hold enquiry into Forest offences under Section 71 of the Forest Act. Divisional officers *ex-officio* hold all powers under this Section. But I fail to see the illegality of my action. The enquiry held by the Ranger has no status in a court of law. It is merely to enable the Divisional officer to judge of the truth or otherwise of the statement of the official originally reporting the offence.

To secure as far as possible an accurate and trustworthy report, I take the precaution of having the enquiry made before respectable outsiders. It is in no sense an enquiry under Section 71 (*d*). Again, why is my method "not Section 67?" In that Section there is no provision that before the duly empowered Forest officer accepts composition he should make an enquiry under Section 71 (*d*). I am satisfied that an offence as reported to me has taken place. I therefore offer the accused the alternative of compounding. To do so is entirely optional on his part. What is there in the Act to prevent me, on receiving a report of a forest offence, there and then to offer to the accused the alternative of compounding or standing a prosecution? There is nothing in the Act by which an enquiry by a Forest officer is necessary before demanding composition under Section 67, nor is such provision required, for the framers of the Act evidently credited the public with sufficient common sense to refuse to pay composition when not guilty of the offence it may be charged with.

Reference to pages 156 and 298, Vol. VIII. (not Vol. VII.) does not show me any remark on Mr. Baden-Powell's part to the effect that only those cases which come under the Forest officer's own cognizance should be treated under Section 67.

On the contrary (page 299, first line) he distinctly says—"It was *never* intended that in *every* forest case, the Forest officer should make an investigation, though every higher grade officer may reasonably have the *power to do so*." (The italics are his not mine). In these petty cases occurring from 50 to 100 miles from head-quarters, of which, in my division in 1887-88, despite a staff so numerically weak as to be unable to properly guard their forests, 1,819 were reported to me, it would be utterly impossible for the Divisional officer to hold a regular enquiry under Section 71 (*d*) in every instance. But where is the illegality in my deciding them without having done so? Most of these offences consisted of the taking out from Class B reserves of one or more cart-loads or other loads of produce without a license. To have dragged the people concerned from one end of the district to an-

other would have been cruel to the witnesses, and destructive to the efficient guard of our forests from the absence of the staff engaged in the case, and on the same grounds it would have been almost if not quite as inconvenient, to have sent every case to a Magistrate. I of course hope that your readers do not imagine from remarks made by me, with regard to there being no *necessity* of enquiry before demanding composition, that I never adopt such procedure. I simply wish to answer "Single S." It seems to me that Section 67 is much misunderstood, and Forest officers do not completely take in that payment of composition is purely optional on the part of the accused, and that he can always, by refusing to pay, force the Forest officer either to bring the case into a court of law, or throw it up altogether. GORARH.

---

## THE NALA PANI SPRINGS, DEHRA DUN.

I THINK it incumbent on me to ask you in your next issue to point out that the surface drainage of the Gurkha encampment, termed "cholera camp" by your contributor "A. C." in his article regarding the water supply from the Nala Pani spring, does not tend towards the 'catchment basin' of that spring.

The camp was not a "cholera camp" in the usual acceptation of the term, but simply an encampment located to accommodate the married Gurkha Soldiers of the 1st Battalion of our local Corps, and thus remove them from the precincts of cholera-infected quarters—*not a single case of sickness af any kind whatever occurred amongst those located in the cholera camp during its existence on the site alluded to.*

I may also mention that the scheme for bringing in the water referred to, in exactly the same manner as is now being carried out by the Municipality, but at a much higher and therefore better level, *viz.*, to a point near the Church on the Rajpur road, above the *Dilaram* Bazaar, was brought forward in 1875 by Mr. W. Holmes, C.S., then Assistant Superintendent of the Dún, but fell through for want of higher official support.

Samples of the Nala Pani water were at that time sent by me to Dr. MacNamara, Government Analyst, Calcutta, for report and examination, and he then declared that it was "one of the purest natural waters he ever analysed." Dehra has, therefore, *at last* something to be proud of in now possessing, limited although the supply be, *drinking water of a quality unsurpassed* by *any in* India.

DEHRA DUN,
*14th July, 1888.*

G. G. MACLAREN, M.D.,
*Civil Surgeon.*

# LOWER CALIFORNIA.

It may interest those of your readers who have read in a recent number of your valuable magazine for May 1888, that the white pine is gradually disappearing from the forests of the United States, to know that a large belt of wood, composed principally of yellow and white pine, has been recently discovered in the centre of Lower California. This belt is from 60 to 75 miles in length, and from 15 to 25 miles in breadth, and covers an area of nearly one million acres, one-half of which is covered with well grown pine.

Two trees that had recently fallen were measured by the explorer, and gave the following results :—

No. 1. 180 feet long, 8 feet in diameter at the butt, 50 feet to the first limb, where it was 5½ feet in diameter.

No. 2. 201 feet in length, 8 feet 2 inches in diameter at the butt, 65 feet to the first limb, where it was 5 feet in diameter.

Fifty-four acres were measured as an average of the region for growing timber, and it was found that 24 large and 8 small trees formed the usual crop.

The upper portion of this pine belt will soon be traversed by a railway, and a large river, which is filled by five branches, flows through the lower end to the coast. It is to be hoped that the proprietors of this valuable forest, will not permit it to be given over without supervision to the ruthless axe of the lumberer. The rainfall of the summer of 1887 was found to amount to 30¼ inches, but if this falls on a hill denuded of its natural covering, its value to the valleys of the plain will be greatly lessened.

*St. Andrews, N.B.* GEORGE CADELL.

## III. Notes, Queries and Extracts.

Forests of Tunis.—The following interesting account of the forests of Tunis has recently been issued from the Foreign Office in the form of a Consular report.

The forests of Tunis which cover an appreciable part of the surface of the country were, until the French occupation, subject to no supervision, and suffered from many causes resulting from the want of that supervision. In 1883 the French, alive to the importance of preserving what remained of these forests, which are the property of the State, placed them under the management of a separate department, which has carefully explored their extent and conclusively demonstrated that they are an important element of national wealth.

The explorations of the new department have resulted in the division of the forests into two main groups; one consisting of the cork tree and deciduous oak, locally known as "Zen," covering the north-western angle of Tunis, where it abuts on the Algerian frontier and the sea, inhabited by the Kroumirs, and separated from the rest of Tunis by the river Majerdah. These trees grow in a stratum of sandstone, which again reposes on the upper chalk, and they completely disappear where the latter stratum crops to the surface. They cover an area of about 360,000 acres, on 330,000 of which flourishes the cork tree, and on 30,000 the "Zen." It is found that the former invariably grow on the southern slopes of this mountainous region; and on the northern slopes and in the hollows of valleys the latter.

South of the river Majerdah both these trees disappear, and give place to the pine and a species of evergreen oak. They are scattered over various mountainous regions of no great elevation, all comprised in the northern half of the Regency, where alone the rainfall is sufficient to sustain their growth. The principal forest groups are found in the following places:—Zaghouen, Djuggar, and Jebel-el-Erssaas not far from the city of Tunis; Kessera and the Zlass mountains further south; Sidi Yussef Wady Melegue Nebeur, and Haydra further towards the west. It is calculated that these several forest groups cover a surface about equal to that covered by the cork trees and "Zen," *viz.*, 360,000 acres.

These latter forest groups are in a more neglected state than the former. For the most part they are nearer to important towns than the cork forests, and from time immemorial have supplied those towns with fuel. The bark of the pine is also used for tanning and colouring hides and skins, and as no control is exercised over the cutting down of trees or stripping them of their bark, and goats are allowed to roam everywhere, the forests are rapidly deteriorating. No legislation has as yet been adopted for putting a stop to this waste, and though the Department of Woods and Forests proposes that the Chiefs of the contiguous villages and tribes should be held responsible for the depredations, the Government has not yet ventured on this high-handed measure.

It is to the cork forests that the attention of the new administration has been mainly directed. They are situated in a country with a very sparse population, dwelling in huts formed of the branches of trees. Their number is estimated at 18,000 souls, or only one individual to 30 acres. It was open to the French administration which wields the authority of the Bey to adopt one of the three following systems in dealing with the woods and forests, *viz.*, their sale, their concession for fixed periods, or their management by the State. The last was chosen as the system best adopted for their preservation and extension, particulary as it is held to be of paramount importance to favour the increase of rainfall in the country, the quantity of which is supposed to be intimately connected with the extent of the forests. That they were more extensive in the times of the Romans, and that they conduced to augment the annual rainfall, may be inferred from the discovery of numerous aqueducts among hills, which are now absolutely denuded of trees and destitute of springs.

Much has been done during recent years in improving the condition of these cork forests. Roads have been cut through them, and at stated intervals spacious alleys have been frayed to serve as a means for arresting the march of the destructive fires which frequently ravage them. Above all much progress has been made in barking the cork trees—an operation which consists in stripping the rough bark of the trunks of the trees to the height of 5 or 6 feet from the ground. This virgin bark is without value, and only ten years after the trees have been robbed of it the inner bark is available for commercial purposes, the trees giving a crop of cork every ten years. To meet the expense incurred in these operations, there were available the sums accruing from the sale of the trees already felled, and of the bark of the "Zen" for tanning. Little has been done towards working the less valuable for-

ests to the south of that river. An experiment has been made in planting with trees small tracts of mountain land near Hammam-el-Enf, some ten miles to the east of the town of Tunis. The operation consists in digging holes at short distances, and in dropping in each a few seeds of the pine tree. Several hundred acres have thus been planted with tolerable success, at an expense of £4 10*s*. an acre.

The worst enemies of the forest are goats. Some French colonists have taken steps to exclude these animals from their estates, and the result has been that shrubs, which never attained the hieght of more than 2 or 3 feet, have in four or five years assumed the dimensions of trees. This is particularly apparent in the large domain of Enfida, near Susa, belonging to the Franco-African Company, where the Thuria, a species of cypress—which covers much of that domain—from a dwarf shrub has now within the space of six years attained a height of 20 to 25 feet. The French Railway Company, which owns the line running from Tunis to Algerian frontier, has succeeded in planting a considerable number of the *Eucalyptus resinifera* (the Red Gum tree) and *Acacia cyanophylla.* It is estimated that 300,000 trees have been planted along the line of railway.

The cost of planting an acre with the eucalyptus amounts to £20, about 1,600 trees going to the acre of nursery ground. After planting out, it is probable that at the end of 20 years 600 trees will have survived, worth 8*s*. a piece.

The bark of the *Acacia cyanophylla* is rich in tannins, and valuable for the tanner. In the whole of Southern Tunis there exists but a single forest formed of a species of acacia. It is situated about 25 miles inland from Ifax, and covers an area five miles long by a little over a mile in width. This forest, which was formerly much more extensive, is protected from the northerly winds by high land, and the trees grow in clumps in depressions of alluvial soil. Though they only attain a height of 10 feet, the trunks furnish planks 8 or 10 inches wide, of an exceedingly hard grain, and capable of taking a fine polish.—J. R. J. in *Gardener's Chronicle.*

---

THE TROUT'S PRECEPT—AND PRACTICE.

If birds can talk, as Æsop, Gay,
With Phædrus, Grimm and others say,
And beasts can signify their wishes
In prose or verse, then why not fishes ?
Horace, 'tis true, has called them "mute" ;
But talk they do beyond dispute.

And if you'll listen to my story
I'll demonstrate the fact before ye.
  Where Thames with silver current flows,
Nor yet with scent salutes the nose,
Or furnishes the missing link
Between "Superior Stout" and Ink,
Snug in a hole beneath a weir
An aged trout had made his lair.
*He was the hermit of the reach,*
His hoary scales and sapient speech
Combined among the finny nation
To give him wisdom's reputation.
Full many a time and oft they say,
From rod and line he broke away:
While curses loud and deep as thunder
Lit on the piles he darted under.
The deep experience gained by age
Had made him now so trebly sage
That all in vain the lure was spread,
Dace, lobworms, flies, or lumps of bread:
He would'nt even smell a "Pirate."
(I hope G. K. will not be irate).
In vain the angler searched his book,
He "slung," but would'nt take, "his hook."
  Feeling at last the end was near,
When water should become his bier,
He sent for all the finny clan
And thus his farewell speech began:
"My friends," said he, "before I go
The way of all fish here below,
This legacy I leave, a plan
To circumvent that monster, man."
  At once there issued loud applause
From all the circle's gaping jaws.
For joy (in lieu of clapping hands)
*They smote their tails against the sands.*
  With conscious pride the veteran smiled,
And thus resumed in accents mild:
  "The fatal step, as I'm a sinner,
That ruins us is fish for dinner.
I own myself, in earlier years,
Before repentance sprang from fears,
I've eaten minnows, dace, and bleak,

Hundreds at least, or more, a week.
What toothsome food the rascals were,
And plump!—but that's nor here nor there.
While heedless thus we gormandize
Man stands above with watchful eyes.
He marks our haunts, he spies our ways,
Then right across our path he plays
In placid stream or purling brook
A live bait tethered to a hook.
Oh! ne'er can memory forget
That piercing pang—I feel it yet—
When first the barb's tenacious grip
Clung to my lacerated lip.
I rushed and tugged, and fought in vain,
'At each remove I dragged a lengthening chain.'
At last, impelled by wild despair,
With lively bound I leapt in air.
Flick went my tail, the line gave way,
Or else I'd not been here to-day.
But, oh! my friends," (he raised his eyes,
Devoutly turned towards the skies)
"Be warned while yet 'tis time, and flee
This fatal vice of gluttony.
Why should we prey on one another?
Is not the dace a fish and brother?
Believe me, worms and grubs and flies
Are most unwholesome luxuries.
The choicest morsels, rarest treat,
Are oftenest barbed with man's deceit.
Safe from his wiles in peace I feed
And mortify the flesh on—*weed*."
  *He ceased, and, with seraphic smile,*
  Beamed like a halo'd saint in "ile."
Amazement seized the scaly crew,
When thus the pike made answer due:—
  "I must confess our friend the trout
Is somewhat late in finding out
That virtue, safety, all we need,
Lies in a vegetarian creed.
His arguments had moved me more
Had he propounded them before.
Now that his teeth are gone, his teaching,
From lack of practice, turns to preaching.

Perhaps old blood and feeble bones
Can live on weed, or snags, or stones!
A weed, forsooth, when one is ill,
May serve as a cathartic pill.
In my case Dr. Carp's prescription
Is of a different description.
He recommends of dace *quant: suff:*
Of gudgeon, minnow, bleak and ruff
*Haustum quotidie capiendum*
As long as Providence shall send 'em.
I can't find anything to shy at
In such a truly generous diet;
The new *régime* I'll gladly follow
*When*—I find nothing else to swallow."
Approval shone from every face,
When, lo! an uninvited dace
Came slowly wobbling past the chair.
"Insolent upstart, does he dare
To interrupt our conference,
And deem unscathed to get him hence?"
"No," cried the Trout, "for once my vow
I'll break, and teach the rascal how
To rue his beggarly intrusion."
He snapped him up. When, oh! confusion!
Once more he found his lip impaled.
Not now his youthful strength prevailed;
The friendly piles were far away,
And death had marked him for his prey.
The pike, amidst the consternation,
Thus spoke his funeral oration:
"My friends, our dear departed brother
Has left this world to try another.
Whether his fate shall be to fry,
Or stuffed to grace a wall on high,
These mysteries we may not pry.
I fear up there he'll have no need
To test his theories on *weed.*
I always warned him not to fast;
I fear his mind gave way at last.
He mixed, a melancholy fact 'tis,
A pound of theory to an ounce of practice.
As for us miserable sinners,—
We'd best disperse and get our dinners."
—*Land and Water.* CI GÎT.

## SÁL TREES IN THE GARO HILLS.

One hundred and twelve sál trees in the Dambu forest, Garo Hills, on conversion yielded 1,065 sound logs, from which 148 broad gauge and 7,190 metre gauge sleepers were sawn.

This gives an average yield of 90 cubic feet per tree of marketable timber, but the careless sawing, and a too rigid specification of good sleepers, caused a large waste.

Our correspondent states that he has seldom seen a sál tree in Dambu exceeding 6 feet without a prominent heart-shake.

---

We read in the "Cape Mercury" that the Comt De Vasselot, Superintendent of Forests in Cape Colony, is replacing Mr. D. *Hutchins* at *King Williams Town*, and that the latter officer is to be transferred to the Knysna, and we hope to hear from him regarding forest matters in this remote region.

---

We regret to state that the Brandis Sylvicultural Prize could not be awarded this year, as the only competing Essay was in the form of a report and not a sylvicultural essay in accordance with the rules for the prize. The rules are now being revised, and we hope that next year some of the passed Dehra Dún Students will compete.

THE

# INDIAN FORESTER.

Vol. XIV.] September, 1888. [No. 9.

## THE FORESTS OF MANIPUR.

(*Continued from page* 344).

### II.—The Valley and Mountains of the Central Division of Manipur.

The view of the valley of Manipur proper as obtained from the crest of the Limatol Range, is both beautiful and striking. Looking east and stretching north and south from the visitor's feet, a vast plain expands interspersed with rounded hills, sparkling lakes, and winding sluggish rivers, while far away to the east the panorama is closed in by rugged blue mountains, (the Hírok Ranges,) which, like the Limatol, extend almost in a meridional direction. At both extremities this fertile plain is hemmed in by the central hillocks, which rise higher and higher until they unite with the Limatol and Hírok Ranges—thus presenting the appearance of a verdant land-locked basin. The valley is indifferently cultivated; but bright green rice fields set off with clumps of dark-foliaged trees and feathery bamboos, mark the sites of scattered villages. A long straight path is seen to run from a small village and Police-station known as Bishenpúr at the foot of the Limatol Range, for 12 miles N. N. E., to what appears as a dense forest. This is the capital of the State—Imphail. The eye loses the detail of this somewhat monotonous expanse as the road dwindles into a mere gray line which is seen to be carried across the silvery tributary streams which descend from the Limatol mountains. Neither spires nor chimneys cut the blue sky, nor is smoke observed to ascend from the sylvan scene of the capital. Nothing in fact bespeaks the busy home of 30,000 to 40,000 people, and yet, hidden away among these trees, is the palace of the Rájá, and hard

by are the houses of his favourites—each family having a large enclosure around the homestead. Imphail may thus be described as a city of villages or rather suburban residences around the palace. Straight wide roads lined with trees, frequently intersecting each other at right angles, afford the means of communication; but neither shop, artisan, nor wheeled conveyance exists in the city. Industry and skill occur only in the distant rural homes. The people of the capital are the promoted favourites of the ruler who have had assigned to them plots of ground near the palace; and, in descending degrees in power of piracy, live upon the persecuted agriculturists of the State. Unique of its kind, the capital of Manipur is a Royal residence dedicated to luxury and amusement. All are happy. The streets are crowded with smiling healthy faces, in which few bear the lineaments of toil and labour. The children scamper after each other with merry shouts, or besport themselves in juvenile mimicry of the games and amusements of their fathers. There are no schools in the State, and Court favour and promotion are secured by success in the manly game of polo, or as it is called by the Manipurís—Khanjái. Coinage, one might say, is unknown, and the men are not allowed to trade. Imports and exports, excepting in certain articles that yield a Royal revenue, are practically prohibited. The women from the distant villages repair on certain days to the capital or to other recognised centres. Each carries on her head a neatly made square basket, in which has been placed the surplus stock of the homestead—the labours of her industrial skill or of her husband's agricultural knowledge. On reaching the market-place the contents of these baskets are exposed and exchanged or bartered, when each returns again to her family carrying off the results of her loud and hotly-contested exchange.

On market days the long straight road from Bishenpúr to Imphail may be seen crowded by groups of women hurrying to and fro, while the merry laugh is made to beguile the otherwise dreary march. Each wears an elegantly striped dress in bright colours made of silk or cotton. The stripes run along the length, and the top and bottom are neatly embroidered. This long piece of cloth is cleverly carried across the breasts and just under the arm-pits instead of round the waist, and is firmly tucked up, so that the top embroidered edge falls forward adding an additional fold to the garment, while the bottom edge reaches a little below the knees. The legs and arms are left exposed, but frequently a short green silk sleeveless jacket covers the upper part of the body reaching down to the top edge of the nether garment.

Along the stretch of dreary road these women hurry unmolested, and from the power given them as the only traders in the State, they by no means seem unhappy.

The contrast between the Cachar-facing densely wooded ranges and the slopes of the Limatol, bordering on the valley, is indeed remarkable. A grassy wall is seen to rise to a height of from 5,000 to 6,000 feet, the long gray monotony of which is only occasionally broken in the gorges by clumps of trees near the Naga villages. Large herds of cattle and buffaloes may be seen grazing on these rich grassy slopes, but the effects of the denuding of forest is everywhere seen. The rounded hillocks within the valley rise up exposing their barren red-clay heads, which on closer inspection are often seen to bear the stumps of old pine trees, ruthlessly hewn down for firewood, while no effort was made to replace them. The forests of the valley referred to as seen around the city are the sacred clumps of trees surrounding the homesteads; for, where not cultivated, the fertile soil of the valley bears but a malarious crop of rampant tiger grass. There are several lakes, but the great one to the south and east of Bishenpúr, the Logtak, need alone be specially mentioned. The valley of Manipur proper is an irregular oval, about 36 miles long and 20 broad, the southern and lowest portion being occupied by a vast expanse of lake and marsh. Near the capital the valley reaches its greatest altitude, being there 2,750 feet above the sea, but beyond the Logtak the land again rises with only one outlet for the water. Thus then, saucer-like, the valley of Manipur is hemmed in on all sides, and bears abundant evidence that the Logtag is perhaps but the remains of a lake or inland sea that once covered the whole area. Numerous salt springs exist, from which the Manipurís manufacture all the salt used in the State. The soil of the valley, with a recent top of humus, is a rich deposit of sand and mud. The rocks are all stratified and apparently of cretaceous age. Limestone occurs in one or two localities, and the streams often carry so much lime that the trees growing near their margins have their stems petrified or encased with lime up to the height of the highest flood. Every bough, twig or leaf that falls into these streams in a like manner becomes encased with lime, and so beautiful and delicate are the petrifications, that a leaf may be picked up in which the minutest reticulations are worked out in a limy deposit. To the east in the Kassome range, beds of carbonaceous shale or coal occur, which is never, apparently, used as fuel by the people. Slaty rocks are frequent, and quarried into large slabs, which are employed by the people to cover the roofs of their houses. On the Kabo side of Manipur

hornblende and ironstone are met with and also fuller's earth. In some of the hillocks within the valley, this fuller's earth is regularly excavated and sold in the bazars, being eaten by *enceinte* women. The iron ores where met with are regularly worked, and the spear-heads and swords used in the State are made of laboriously collected and carefully worked metal.

These are the characteristic features of Manipur. Each river basin, once or twice during its course, widens into saucer-like valleys formed from silted-up lakes, which may often be seen in the process of disappearance. Indeed the Logtak itself is studded with immense floating islands of weeds that are gradually subsiding under the accumulation of drift soil and decaying vegetable matter—agents which seem to have taken a no inconsiderable part in the drying up of the Manipur lakes. In many of the valleys, moraine-like walls are seen either running across, or fringing the sides. These appear to have been entirely formed by the rivers, which in time have cut through their retaining or containing walls, and thus left shattered barriers or skirting embankments to mark their former levels. Colonel Godwin-Austin explained these walls as due to ice action, but a recent geological explorer has attributed them to water alone. Be that as it may, rich shelving banks and flat valleys form a striking feature of Manipur, and where not cultivated, they bear an abundant herbage of tall grass, ferns, and herbaceous (often umbelliferous) plants, but are rarely, if ever, forest-clad.

Before proceeding north through a series of these lake-like valleys to the higher central division of the State, I must endeavour to convey some idea of the characteristic vegetation of the main valley of Manipur which embosoms the capital, Imphail. The moister portions of this valley may be said to have a closely-allied assemblage of plants to those met with on the Central Bengal mountains with a tendency, on the exposed red clay hills, within the valley, to types of a drier and warmer character, such as *Eriolæna spectabilis*, *Woodfordia floribunda*, *Terminalia tomentosa*, *Zizyphus*, *Capparis*, &c. A walk along any of the roads that penetrate through the assemblage villages which form the capital, would result in the discovery of most, if not all, the following species, for they are everywhere plentiful :—*Glycosmis pentaphylla*, *Vitex Negunda*, *Cleome viscosa*, *Icnocarpus ovalifolius*, *Flacourtia Ramontchi*, *Bryophyllum calycinum*, several species of *Solanum*, with, in the ditches and stagnant water, *Ottelia alismoides*, *Sagittaria*, *Alisma*, *Pistia Stratiotes*, *Lemna*, &c. On the damp banks *Colocasia*, *Commelyna*, *Jussieua repens*, and *suffruticosa*, *Marsilea*

*quadrifolia*, *Ipomœa aquatica*, and other such plants. In the hedgerows, and seeking the shade, *Rosa involucrata*, *Clerodendron* (a large double-flowered form), and *Buddleia macrostachya* and *paniculata*, *Hiptage Madablota* and *acuminata*, *Buettneria pilosa*, *Odina Wodier*, *Erythrina stricta*—the last two in great abundance, the red flowers of *Erythrina* being particular favourites with the Manipuris—while here and there along the road-sides occur *Ficus religiosa* (often forming sacred clumps with surrounding mud embankments and red painted stones), *Ficus hispida*, *F. uniglandulosa*, *F. obtusifolia*, *Artocarpus Chaplasha*, *Bauhinia variegata*, *Cratæva religiosa*, *Melia Azadirachta*, *M. Azedarach*, and an interesting and rare species, *M. Toosenda*, with *Cedrela Toona*, bamboo, and, on shady banks in grassy situations, *Potentilla supina*, *Inula Cappa*, *Polygala leptalea*, *Osbeckia stellata*, along with other such sub-tropical herbaceous plants. It is interesting to add that, dispersed among these indigenous plants occur many of the invading foreigners that are claiming so much of tropical India, such as *Argemone mexicana*, *Bixa Orellana*, *Jatropha glandulifera*, *Nicotiana Tabacum*, &c. In the lakes also, the American Duck-weed (as in Bengal tanks) threatens to exterminate the indigenous plants. I must not omit to mention another introduced hedgerow plant, which perhaps a few years hence, we shall learn has left the garden enclosures and advanced into the jungles—*Datura suaveolens*. This elegant plant, with its pendulous white flowers 6 to 8 inches long, seems quite acclimatised, and to be much appreciated by the people.

Of cultivated fruit trees the mango, with large stone and inferior fruit, occurs occasionally, and along with it *Prunus persica* (the peach, gone wild on the hills near the sites of deserted villages), *Elæocarpus floribundus*, and a plum, which I take to be new to science, and which provisionally I name in honour of Manipur—*Prunus manipurensis*. This has a leaf not unlike that of *Rhamnus dahuricus*, and the fruit, small, shining green, is covered with curious tubercles. It is not very luscious, being of a sour-sweet flavour, but is much relished on a hot march. This fruit I made acquaintance with in February, on a march from Manipur to the north. Some 11 miles from the capital, as we were nearing the village of Sengmai, my men ran up the side of a sloping ledge, to a small village to purchase fruits and vegetables. I followed and found a basket of this fruit exposed for sale. A reward offered for a branch of the tree, secured for me some half-an-hour after, a bough with the fruits attached. Two months, subsequently, on my return to Manipur I made every effort to see the tree, but failed. I

presume it is, therefore, not plentiful, and I have not seen the flower which doubtless appears in Autumn. The fruit is, however, so peculiar, that there can be little doubt but that the isolated State of Manipur possesses in this, a peculiar and characteristic plum which may have been cultivated there for centuries without, so far as I have since been able to discover, having left the State. In this connection it is worthy of remark that while working through the collections of *Prunus* in the Calcutta Botanic Garden's Herbarium, I came across a specimen collected by Oldham in Japan (No. 190), which seems closely allied to the Manipur plant. It would not indeed be at all surprising were it proved to be identically the same form, since a strong Japanese taint exists in Manipur, such for example as the appearance in the forests to the north of a species of the Sacred Star Anise tree of Japan. The specimen collected by me has been examined at Kew, and pronounced to be a new species of *Prunus*, so that it seems probable the above name may come to be accepted as sufficiently justified.

Before passing away from the immediate vicinity of Imphail, I may as well say something of its lake vegetation. Selecting the Logtak for that purpose, I would only add here that the lakes are so much alike, that what I say of one applies practically to all. The American Duck-weed, along with *Salvinia imbricata*, *Azolla pinnata*, *Lemma* and *Pistia Stratiotes* form so dense a scum that boating is often impossible, excepting along the channels kept clear by the fishermen. The graceful leaves of *Nelumbium speciosum* form dense expanses, within which thousands of duck and teal besport themselves. The sacred Lotus is indeed so plentiful as to remove all suspicion of its not being indigenous, but strange to say, the blue, white, and red, water lilies of the Bengal tanks are remarkably scarce, their place being taken by the prickly leaved species *Euryale ferox*. This affords an edible fruit which is sold on the roadsides of Manipur, the baskets of the curiously dissected sopari-nut (*Areca Catechu*) and the spiny *Euryale*, recalling the baskets of sea hedge-hogs, exposed for sale in Mediterranean coast towns. *Trapa natans* takes the place of the ordinary singara nuts of Bengal (*T. bispinosa*); and great boat loads of this nut may be seen punted up the rivers from the Logtak lake to the town. A large yellow-flowered *Limnanthemum* disputes possession with the white-flowered species—*L. indicum*, and *L. cristatum*. This is particularly abundant in the moat around the Raja's palace, and seems to me to be quite distinct from the two Bengal species mentioned above. I identified it as *L. Kleinianum*, Griseb, a form which appears from the Flora of British India to be referred to *indicum*.

If this be so, then surely there is but one species of *Limnanthemum* in all India, for it would be difficult to point out two plants more unlike than the ordinary small white-flowered *L. indicum*, and this large elegant plant, which at a distance recalls the yellow water-lily of Europe—*Nuphar lutea*. Floating or submerged in the Logtak lake, or growing on its subsiding islands, were gathered *Valisnaria spiralis*, *Potomogeton crispus*, *P. oblongus*, *Scirpus lacustris*, *Juncus Leschenaultii*, *Fimbristylis rigidula*, *Myodendron ignium*, *Utricularia flexuosa*, *Lycopodium squarosum*, *Carex nitella*, *Colacasia*, *Alisma*, *Sagittaria*, &c. From the shallow margins were procured various species of coral-like *Chara* and *Nitella* seem glistening in fairy banks, through which brilliantly coloured small fish darted in sportive chase, or flashed from clump to clump on being disturbed by the splash of the oar. Dreamily the large cray-fish were seen crawling along, while over the mirror-like surface myriads of aquatic birds disported themselves, their gay plumage reflected in the diamond drops of water glistening over the leaves of the water-lilies. On the mountain-islands *Callicarpa*, oak, *Cycas*, *Phœnix*, and pine, form a rich arborescent and brushwood contrast, which greatly enlivens this tropical lake scenery, while affording a curious but charming confusion to its floral characteristics. The *Cycas* occurs (as far as my experience of Manipur goes) only on these humid island-peaks, while the alpine date-palm re-appears on the mountain ranges to the east. It may be here mentioned in passing that in many of the Reports on Manipur issued by the Political Residents, it is stated that palms do not occur in the State. This is quite a mistake: the alpine date-palm is common, the sago-palm by no means rare, and the bridges over the rivers are invariably constructed from the climbing palms or rattan canes which occur in profusion both in the eastern and western forests.

Space cannot be afforded to deal in detail with the cultivated plants found in the valley. Rice is the staple crop, and there are some 20 to 30 recognisable forms grouped in two sections—early and late. The early ripens in three months, and is harvested in September. Of this class there are four kinds. The late rices take six months to reach maturity, but the majority of the best rices belong to this class, and they are reaped in November. Wheat to a small extent is sown in Autumn and reaped in Spring. Cotton is rarely grown in the valley of Manipur, but is largely raised by the hill tribes on the adjacent mountains, and is sold in Manipur, where it is spun and woven. On the hills, as an escape from deserted cultivation, semi-wild cotton of a very inferior quality is commonly met with. Many forms of pulses and lentils are grown, including dál, kesari, múng

and soya. There is a form of *Lathyrus* cultivated, which I take to be a perfectly distinct species, and which I have named *L. imphailensis.* English vegetables, peas, beans, &c., are grown throughout the year, and potatoes of an inferior quality have become a regular article of diet with the Manipuris. The sopari-nut has to be imported from Cachar, but the betel leaf is largely grown locally, as all the Manipuris have become inveterate chewers of pán since they became Hindus. The plantain is seen in most gardens, and the pine-apple succeeds admirably. Silk-worms are reared by about 300 families of a low caste, and the mulberry tree on which the worms feed is allowed to grow wild in certain valleys. No care is bestowed on the selection of either plant or silk-worm stock; the process of reeling is primitive in the extreme, and yet excellent silk garments are sold in curious triangularly folded pieces.

Perhaps the most striking agricultural product in Manipur is a Primulaceous plant, regularly cultivated as a green vegetable to be eaten along with fish. This is a species of *Lysimachia*, known to the Manipuris as *Kengoi*, and is probably *L. obovata*, Wall. It is closely allied to *L. caudata* of China, if the two should not be viewed as the same. This is perhaps also Hance's *L. Samolina.* But the fact that a *Lysimachia* is actually eaten as a pot-herb must be regarded as extremely interesting, for hitherto almost no primulaceous plant has been recorded as used for any economic purpose. One or two *Lysimachias* are stated to have doubtful medicinal properties. *L. fœnum-grœcum*, Hance, the author states is used for perfuming hair oil in China, but he adds that he thinks "it might be profitably employed in the compounding of cattle food." It seems probable that all the translucent gland-dotted *Lysimachias* may be found, as in present instance, to be wholesome if not sufficiently distinct in other respects to justify their separations as a sub-genus. They all recall the genus *Mœsa*, and may thus be viewed as affording an additional link of connection between *Primulaceœ* and *Myrsineœ.*

Of dye stuffs may be mentioned *Carthamus tinctorius*—safflower, *Strobilanthes flaccidifolius*—rúm, kúm, or indigo—and madder, but strangely enough the madder of Manipur is *Rubia sikkimensis* not *R. cordifolia.* Of fibres, cotton and silk are all that the State produces, and of resins the kind of Japan varnish met with also in Burma, namely *Melanorrhœa usitatissima.* Tobacco is largely grown, but in the valley *Nicotiana rustica* is the form chiefly met with, while on the hills *N. Tabacum* takes its place.

(*To be continued*).

# DR. CLEGHORN'S SERVICES TO INDIAN FORESTRY.*

SINCE Forestry is now recognised as an important business in India; since it has become possible, by means of protection, and chiefly by means of protection against the annual ravages of fire, to convert the poor jungles of olden days into dense, well-stocked, and productive forests, which yield a large and steadily increasing revenue,—and mainly since experience has shown that Forest Conservancy, instead of doing harm to the people of India, promotes their well-being, and is a blessing to them and their country,—the question has, naturally, often been asked and discussed, in which part of the British Indian Empire was Forest Conservancy first started?

In the beginning of the century the Government of Bombay established a timber agency on the western coast of the peninsula, in order to secure a permanent supply of teak timber for the Government dockyards at Bombay. In 1847, Dr. Gibson was appointed Conservator of Forests in Bombay, and ever since that time attempts have been made, with more or less success, not only to work the Government forests of that Presidency, but also to secure their maintenance, to protect and to improve them.

Soon after Tenasserim had become British territory in 1826, repeated, but at that time mostly ineffectual attempts were made to effect the protection of the teak forests in that province.

In the Presidency of Madras, Mr. Conolly, the Collector of Malabar, commenced (1843) planting teak on a large scale at Nilambur, and this was the beginning of those famous plantations, which have since been steadily extended by the Madras Forest Department, and which are now reported to cover 3,500 acres.

The object of the present paper is not to decide the question, whether Madras or Bombay may claim the honour of having first started Forest Conservancy in India, but to set forth the share which Dr. Cleghorn has had in this business; and hence it will be necessary to review somewhat more fully what was done in this respect in the Madras Presidency, where Dr. Cleghorn commenced his labours.

In May 1847, Captain Frederick Conyers Cotton (now Major-General and Companion of the Star of India) reported to the Government of Madras on the teak in the Anamalai hills, and asked

---

* By Sir D. Brandis, K.C.I.E., late Inspector General of Forests to the Government of India. Reprinted from the Proceedings of the Royal Scottish Agricultural Society, July 1887.

for the services of an officer to explore the forests. The sanction of the Government of India having been obtained to this proposal, Lieutenant James Michael (now Major-General and Companion of the Star of India) was appointed in June 1848. In August 1849, the Court of Directors called for reports on the results of Lieutenant Michael's work. The terms of the despatch are well worth recording, as evidence of the just views entertained at that time by the Court of Directors. They wrote: "We trust that effectual measures will be taken for its conservation (of the Anamalai forest), so as to protect it from the serious injury which other forests have sustained."

Captain Cotton then submitted a report on the operations of felling and converting teak, the making of a road across the hills, and the settlement of the Colengode and Cochin boundaries. He also reported the number of good teak trees standing—

| | | |
|---|---|---|
| In the Cochin disputed territory, | ... | 107,000 trees. |
| In the Colengode ,, ... | ... | 28,000 ,, |
| In the Government territory, ... | ... | 61,700 ,, |
| Total, | ... | 196,700 ,, |

Minutes were written on the subject by Mr. D. Elliot, Member of Council, and by the Governor, Sir H. Pottinger, and in February 1850 the Government sanctioned Lieutenant Michael's services being retained. In February 1851 he was sent to Moulmein to learn the methods of dealing with heavy timber, in December 1853 to the Kanara forests, and in 1854 he was formally appointed Superintendent of the Anamalai forests. The published reports (selections from Madras Records, No. V. of 1855) deal only with timber and roads, and there is no reference to conservancy. Lieutenant Michael, however, did more than this—he brought about the lease of valuable teak forests from the Nambadi of Colengode, and he started a system of clearing teak seedlings, and young teak trees, of dry leaves and other inflammable matter in the forests, so as to protect them against injury by the annual fires of the dry season.

In 1856, Lieutenant Michael went on leave, and Captain (now General) Douglas Hamilton was appointed in his place. He was in charge of the Anamalai forests for several years, and at a later date—after a regular Forest Department for the whole Presidency had been organised—Captain Hamilton was succeeded by Lieutenant (now Colonel) Beddome.

About the time that Captain Cotton first drew attention to the Anamalai forests, Dr. Cleghorn was stationed as an Assistant

Surgeon at Shimoga, in the Nuggur Division of Mysore. Being interested in botany and a keen observer, he remarked the wholesale destruction of forests in that district, chiefly through "kumri" cultivation. It was mainly through his representations that the attention of Sir Mark Cubbon, then Commissioner of Mysore, and of Colonel Onslow, the Superintendent of the Nuggur Division of that State, was drawn to the necessity of Forest conservancy. Dr. Cleghorn's name is mentioned in a Report on the Conservation of Forests, which the last-named officer submitted to the Commissioner in May 1847.* In consequence of this report and of Dr. Cleghorn's representations, kumri cultivation was stopped in the greater part of Mysore and Coorg; and in 1868, while on a tour of inspection through these districts, *the writer of this paper* had the satisfaction of seeing large tracts of country clothed with well-stocked young forests, which had grown up on the old kumri clearings.

In 1850, the British Association for the Advancement of Science, at their Edinburgh meeting, appointed a Committee to consider the probable effects, in an economical and physical point of view, of the destruction of tropical forests. The report was drawn up by Dr. Cleghorn, and was submitted to the Association, which assembled at Ipswich in 1851. The other members of the Committee were: Professor Forbes Royle, Captain R. Baird Smith, and Captain (now Lieutenant-General) R. Strachey. This report gave an exhaustive review of the question as it then stood, and as far as it related to India, and it contributed much to induce influential members of Government in India and at home, seriously to consider the necessity of organising systematic measures of Forest Conservancy in India.

In the Bengal Presidency it was Lord Dalhousie himself who, as Governor-General of India, carried through effective measures for the conservation of forests, chiefly in the newly-acquired province of Pegu; while in Madras Lord Harris took steps in the same direction. In August 1856, Dr. Cleghorn submitted a report to the Government of Madras, containing proposals for establishing Forest Conservancy. These proposals were sent up to the Government of India for sanction, which was accorded in November; and on the 19th December, 1856, Dr. Cleghorn was appointed Conservator of Forests in the Presidency of Madras. An account of the work accomplished during the first five years

* Report of the Twenty-First Meeting of the British Association held at Ipswich in July, 1851, p. 83.

of his tenure of this appointment is contained in three general reports and other official documents, which, with other important unofficial papers, will be found in a little book, entitled, "Forests and Gardens of South India," published by Dr. Cleghorn in 1861, when compelled to come home on sick leave. This book has done much to promote Forest Conservancy in India. The reader must not expect to find in it the record of a complete and scientific system of forest administration, the introduction of which, under the circumstances, at that time would not have been feasible. But the record of the work accomplished by Dr. Cleghorn during this period shows that he directed his attention to such matters as called for immediate action, and that his recommendations in regard thereto were in the right direction. He justly laid great stress upon the necessity of acquiring a good knowledge of the principal trees and shrubs, as well as of the climate, soil, and forest growth in the different forest tracts; he arranged for the supply of timber, charcoal, and firewood; and in regard to the protection of the forests, he studied the chief sources of injury, indiscriminate cutting, fires, and kumri cultivation. The result of his persistent representations was, that by an order of May 1860, the Government of Madras prohibited kumri cultivation in Government forests without previous permission, and directed that *this permission should be given sparingly*, and never for spots in the timber forests. Dr. Cleghorn had thus accomplished for the Madras Presidency the same result which, thirteen years previously, he had helped to bring about in Mysore, and in both cases the result accomplished through his persistent representations has been most beneficial for the country and its inhabitants. Dr. Cleghorn was able to carry his point in this matter, because he was known to be a true friend of the natives; he entertained feelings of warm sympathy towards them, and had made himself familiar with their mode of life and system of husbandry. As a medical man his name was widely known, and he had acquired much influence among the native population. When urging the discontinuance of kumri cultivation in Madras, as he had previously urged in Mysore, he knew that he was proposing measures which in the end would be highly beneficial for the people themselves. Dr. Cleghorn's single-minded desire to promote the welfare of the people was known to those who at that time were in influential positions in Madras, and the confidence which they placed in him was the secret of his success in this important matter.

At a later period kumri was unfortunately again permitted in Mysore, and in Madras the beneficial effect of the order of 1860

has subsequently to a great extent been rendered nugatory by the tendency, which for some time prevailed in that Presidency, to regard as private property a large portion of the forest lands, particularly in South Kanara, that had formerly been considered to be the property of Government. These subsequent mistakes, though they have done great injury to the country and its inhabitants, do not in any way diminish Dr. Cleghorn's paramount merit in this matter. He paid great attention to a proper arrangement of cuttings, so as to secure the maintenance and promote the natural reproduction of the forests. Under his direction numerous new plantations were established, while existing plantations were maintained and extended. Establishments for the protection and proper management of the forests were organised in all districts. The time had not yet come for comprehensive forest legislation, but local rules were issued by Government on his recommendation, which for the time being were sufficient.

On Dr. Cleghorn's return to India in November 1861, he was directed by the Governor-General in Council to proceed from Madras to the Punjab, in order to examine the forests in the Western Himalaya, with a view to obtain reliable information regarding the timber resources of that province, and to institute a systematic plan of conservancy and management. The exploration of the forests in the hills occupied the summer months of 1862 and 1863, while the winter months were devoted to the inspection of timber depôts, brushwood tracts of the plains, and the preliminary arrangements necessary for the formation of the Department. His report on the forests of the Punjab and the Western Himalaya, which was published in 1864, sets forth the results of his work, and has been of great value in facilitating the organisation of forest administration in that province and in those Native States of the Western Himalaya where it was possible, by means of leases, to obtain the control of the forests. His work received from the Lieutenant-Governor of the Punjab great praise, and the Governor-General in Council expressed his concurrence in the high estimation entertained by the Punjab Government of his services.

Meanwhile (in October 1862) the writer of the present paper had been summoned from Burma, where he had been in charge of the forests since January 1856, to advise the Government of India in the general organisation of forest business. On his recommendation, Dr. Cleghorn was associated with him on the 1st January, 1864, and remained in that capacity attached to the Government of India until 1st March, 1865. Previously, in August 1863, these two officers had drawn up a joint memorandum,

which was sent to the Government of Madras, and which urged the necessity of early demarcation of the Government and village forests in the Madras Presidency. These proposals were not, however, at that time approved by the Madras Government, and it may here be added that, in spite of the persistent representations subsequently made on the same subject by the Government of India, no adequate action was taken in Madras towards effecting a separation of the various rights and interests in the public forests and waste lands until the Madras Forest Act was passed in 1882.

In April 1866, while the writer of the present paper was on leave in Europe, Dr. Cleghorn was appointed to officiate as Inspector General of Forests until April 1867, when the thanks of the Government of India were conveyed to Dr. Cleghorn for his long and successful labours in the cause of Forest Conservancy in India. On his return to Madras, he resumed his work in that Presidency with his former zeal and industry. That, nevertheless, during that period much less progress was made in the forests of Madras than in those of other provinces of the Empire, was due to the views of the Government of Madras, which at that time began to manifest themselves. Dr. Cleghorn retired from the service in 1870, but has since been employed every year at the India Office as a confidential adviser to assist Her Majesty's Secretary of State in the selection of Candidates for the Indian Forest Service.

When Dr. Cleghorn laid the foundation of an effective system of Forest Conservancy in Mysore and Madras, Forestry was very little known in India. A commencement had been made in several places, but Dr. Cleghorn was the first to carry out conservancy measures on an extensive scale. His aims were large and comprehensive, but the single-minded devotion to the task which he had set himself gained the confidence of many who might otherwise have been hostile to the new measures advocated by him. A public resolution by the Government of India, of 10th January, 1865,* justly designated him as the founder of Forest Conservancy in India, and added—"His long services from the first organisation of forest management in Madras have without question greatly conduced to the public good in this branch of the administration; and in the Punjab also Dr. Cleghorn's labours have prepared the way for the establishment of an efficient system of conservancy and working the forests of that province."

Since Dr. Cleghorn's retirement from the Indian Service, he has done much for the promotion of Forestry in Great Britain,

* Parliamentary Return on Forest Conservancy, Part I., India, 1871, p. 95.

particularly through the Royal Scottish Arboricultural Society, of which he became a Member in 1865, and of which he has been President on two occasions—from 1872 to 1874, and from 1883 to 1886. It was in a great measure due to his exertions that the International Forestry Exhibition of 1884 was held with such marked success at Edinburgh.

## HOW TO BAFFLE MOSQUITOS.

IN the North-Western Provinces mosquito curtains are seldom used, and it may be that the annoyance from mosquitos is less here than it is in Bengal, where the use of such curtains is perhaps universal amongst the European population.

Some time ago a writer in the "Pioneer" stated, that it was now generally agreed on, that all lotions that had been tried to prevent mosquitos biting you were useless, and the most of them almost as unpleasant as the insects themselves ; but that in time the system gets inured to their bites, and they were hardly felt. No doubt some change does take place, which prevents the swelling up that so often disfigures new comers to India, but still, however long one remains in India, the bites or punctures they make cause great irritation.

Ten years ago I placed a water tank on the top of my house, to work a small fountain in an aviary, after this, mosquitos swarmed in every room, the punkah did not keep them off altogether, and when it stopped they just devoured one ; the irritation in the feet and ankles especially was so great, that I often got up and put them in water to try and allay it.

I used to read for an hour or so after going to bed, and when I got tired, I put the flame of the lamp down low, and went to sleep ; one night just when I was commencing to read, the punkah was extra vigorously pulled, and the lamp was blown out ; now thought I, it will be long before I will be able to go to sleep, and the mosquitos will annoy me greatly, but to my surprise, they did not do so ; once or twice I did hear the sharp sing of one flying over me, in a kind of aimless way, but though I lay awake for over an hour I was not troubled.

The next night the lamp was not blown out, and when I reduced the light, and put it to one side, I was at once troubled with the mosquitos; this made me consider why I was not troubled the night before, and it struck me that perhaps it was owing to the light being out. I at once rose and removed the light into another room, so that the room I was in was dark, the mosquitos subsided at once. I then brought the light in again and the annoyance began. I then said to myself I have made a discovery, instead of rubbing your skin with lotions or covering yourself in mosquito curtains, all you have to do is to surround yourself with darkness and you are safe. I at once commenced to tell my friends of my discovery, but they all laughed at me, no one would believe it possible, that such a simple remedy could protect one, and no one would even try it; so I gave up trying to benefit others, and looked after myself; since then I have tested the thing over and over again, and always with satisfactory results.

Dr. Bonavia holds the opinion, that if the doors and windows are left open, the mosquitos will go out of the house at twilight, and return after they have fed and quietly rest, till the glimmer of light come in again in the morning, when they will go out and come in as before. I think there is no doubt but what some will do this, but some will remain and indulge in richer fluids than the sap of plants affords.

It is a well known device in fattening quails, to keep them in the dark, and several times during the day, to let in a little light, when the birds believing it to be their usual feeding time, eat away; the dim light in the room acts in the same way on the mosquitos, only they are in a continued twilight, and they remain active till they are gorged with blood; moonlight and the morning light getting into a room, sets the mosquitos going, keep all light out and they are quiescent.

ANGUS CAMPBELL.

---

## THE BRANDIS PRIZE.

WITH reference to your note at the end of last month's "Forester" about the Brandis Prize, I would like to point out that we (students of 1886-87) were distinctly told by the Director and Deputy Director of the School to write about something we had seen, or on some work on which we had been engaged; hence the fact that "the only competing essay was in the form of a report," and yet for this very reason you say the prize was not awarded. At

the same time the essay was never judged, but was withdrawn, after having been pigeon-holed, for no less than seven months, in the Director's office.

The Brandis prize has now been offered for four years, has only once been competed for, and never won, and may I think very reasonably be termed a failure. Any strictly sylvicultural essay would be probably more or less plagiarised from Mr. Fernandez's Forestry.

Would it not be better under the circumstances to devote the money to increasing the amount of the miserably inadequate prizes now given at the Forest School, Dehra, and to prevent the unpleasantness of being obliged to reduce prizes by half at the very moment almost of presentation?

J. G. F. M.

*Note.*—Our correspondent refers to an Essay sent in for the prize in 1887, not to the only one sent in 1888, which was not written by a Student of the Dehra Dún Forest School of 1886-87.

Our correspondent also omits to mention that the Essay sent up in March 1887, was then withdrawn from competition, at the writer's own request, and when subsequently after seven months he asked for the Essay to be sent up, it was duly sent up to the Inspector General of Forests, but again withdrawn from competition, at his own request in writing.

We believe that there are two chief reasons why suitable Essays have not hitherto been sent in for the Brandis Prize, the first being due to the fact that Students of the Indian Forest Schools at Dehra Dún and Poona have not been long enough engaged in practical forest work subsequently to their having left School, and the second, to want of sufficient notice being given early in the year that competing Essays should be sent in in March.

The latter difficulty will be avoided in future, by circulation of the rules in January every year to all Executive Forest officers in India, and as our Indian trained students gain practical experience in their own forests, they will have more confidence in their ability to write suitable Essays.

The amount of the prizes at the Dehra Dún Forest School is beside the question; the amount annually offered by Government being always Rs. 200, which has been supplemented by voluntary gifts by Forest officers. The latter naturally vary, having been, exclusive of prizes offered for athletics, Rs. 200 in 1887, and Rs. 80 in 1888.

The Direction of the School is clearly not responsible for this, and the advisability of prizes being given at all is open to question, as the high standard required for an honour's certificate at the Forest School is sufficient inducement for the best students to do their utmost to earn it.—[Ed.]

---

## BAMBOOS FOR FISHING RODS.

Having been requested by the Under Secretary to the Government of India to assist in the matter of obtaining a supply of

bamboos for fishing rods for the English market, I entered into correspondence with the Conservators of several provinces, with a view to getting samples of various kinds of bamboos sent to London for inspection and trial.

Specimens of *Dendrocalamus strictus* and *Bambusa Tulda* were despatched from Burma in March last, and the reports on them have just reached me. The friend to whom they were addressed said he thought *Dendrocalamus strictus* not well suited for making split-cane rods, as though it had considerable substance, it was not straight, and had rather prominent joints. The two specimens of *Bambusa Tulda* appeared to be far better, being nearly straight, having very small knots, and being of fair substance; but unfortunately, in spite of the precautions that had been taken by Capt. Bingham to preserve them, both were worm eaten.

Messrs. Farlow reported both kinds as useless for rod making. Messrs. Hardy say—"the canes are quite valueless for fishing rod making. Compared with the mottled bamboos which are shipped to us from Calcutta, they are much less fibrous, and quite dead in their spring. The mottled bamboo, of which we will send you a specimen if desired, is we believe the best for our purpose, and we should be glad to make an arrangement for a more regular supply of a light quality." I am endeavouring to ascertain the species of the mottled Calcutta cane. I believe the mottling is due merely to the firing the canes are subjected to during the process of straightening.

Some Himalayan *ringáls* sent to London for me through the kindness of Mr. Bagshawe, have been successfully made up into jointed rods; a rod 16 feet 2 inches long is said to cast 28 yards of line. A doubt is, however, expressed as to whether they will stand hard use. A further report on the subject has been promised.

KULU,<br>*24th July, 1888.* F. B.

---

## FRUIT IN THE DEHRA DUN.

In Williams' "Memoir of Dehra Dun" it is thus stated—"Of fruits, the pear, the fig, the blackberry, the lemon, and strawberry all grow wild. When cultivated, those of almost every description, whether European or not, flourish; except the peach, grape, strawberry, and mango. The humidity injures the three first, and the heat is hardly great enough for the fourth." This year I have for the first time eaten mangos grown in Dehra, and to me both the Bombay and country kinds seem every bit as good as those grown

in Saháranpur. The rains were late in coming on this season, and perhaps it is owing to this that the mangos are so good, but are they better than usual?

Fourteen years ago I got some peaches grown on the Markham Grant, Eastern Dún, that were equal to any I have got from Saháranpur; and every year great quantities of strawberries are sold in Mussoorie that are said to come from Dehra. I saw some grapes last month in the Forest School garden, but they were not much to look at or taste.

Will some of your readers let us know if Mr. Williams' statement regarding the peaches, grapes, strawberries, and mangos be correct or not; or if the want of success—if want there be—may not be due to bad gardening, and injudicious selection of sorts. By the pear that grows wild in the Dún does Mr. Williams' mean the *Pyrus communis?*

A. C.

*Note.*—Our experience after seven years in Dehra is that strawberries are the most reliable fruit to grow in the Dún, and succeed every year on well manured and irrigated land.

Peaches are moderately good in Dehra, but in Chakráta, at 5,500 feet, may be produced equal to the best European kinds.

Grapes are produced in Dehra in heavy bunches, but never ripen thoroughly, owing to the advent of the monsoon, and consequent increase of humidity and fall of temperature by ten to fifteen degrees before they have time to ripen.

Apricots blossom, but never form fruit in Dehra at 2,000 feet above sea level, but produce prolifically on the hills above 5,000 feet, and fine European kinds thrive at Chakráta.

The cultivated pears of Dehra from *Pyrus communis*, are only fit for cooking, and apples are only known to ripen above 5,000 feet. The wild pear is *Pyrus Pashia.*

Mangos, lichis, oranges and loquats are produced in abundance and of fair quality in Dehra, almost every year.—[ED.]

## WOOD USED FOR TEA BOXES IN CALCUTTA.

A dispute between certain Shipping Agents and Merchants in Calcutta regarding the quality of certain wood used for tea boxes was lately referred to the Director, Forest School, for decision as to the species of the wood, by Mr. Blechynden, the Secretary to the Agri-Horticultural Society of India.

The wood, which is locally called kaura, and comes from Moulmein, or Assam, resembles that of semal (*Bombax malabaricum*), but has a dark-brown but soft heartwood, which is said in Gamble's Indian Timbers not to exist in semal wood, and all the specimens in the Forest School Museum are free from such heartwood. The

wood may be that of *B. pentandra*, or some other malvaceous species.

Mr. Blechynden states that the wood, especially the darker portion of it, has a decidedly unpleasant odour. It is improbable however, that if properly dried, any Indian wood would corrode the lead coating of tea boxes, such corrosion being generally due to the use of green wood still containing sap.

Almost any wood of moderate specific gravity will do for tea boxes, provided it is hard and the grain twisted enough to hold nails, and the common mango furnishes one of the best woods for the purpose.

The School Museum does not contain all Indian woods, but chiefly those given in the numbered catalogue of Indian woods at the end of Gamble's Indian Timbers.

If Foresters all over India would kindly from time to time send to the Forest School well authenticated specimens of other woods not given in that catalogue, the collections there would be far more useful than at present, as the School Museum is apparently the only place in India where woods can be readily identified, and demands for such identification have recently arisen several times.

We may note that Gamble's book states that semal wood has no annual rings, this is not always the case however, and Mr. Angus Campbell, formerly of the Roorkee Workshops, states that semal when old has a very dark, almost black, heartwood, and that most of the semal trees from the Chandi forest, felled for well-curbs for the dam across the Ganges at Narora, had dark heartwood, which appeared strong and was hard, and used to puzzle people when planed and polished, and they were told it was the despised semal.

---

## COPPICE SHOOTS OF *DALBERGIA PANICULATA.*

The *Dalbergia paniculata*, a moderate sized tree attaining a girth of 5 to 6 feet and height of 60 to 80 feet, is widely distributed throughout Southern and Central India, and is also found in the Sub-Himalayan tracts to the east of the Sárda river. Unlike its allies *D. sissu* and *D. latifolia*, which form dense highly coloured useful heartwoods, the whole wood is whitish-grey and soft, and abnormal in possessing narrow soft layers of parenchyma alternating with broad concentric masses of wood, so that planks cut out of old trees often fall to pieces.

Specimens of this wood have just been received at the Forest School from Mr. S. C. Moss, Sub-Assistant Conservator of Forests,

Tinnevelly, Madras, which show coppice shoots springing from the zones of soft tissue between two of the concentric layers of the wood; in one specimen the shoots are from close to the centre of the stem.

The stumps were 12 inches in radius, and the concentric rings vary from half an inch to a whole inch in thickness.

In the case of the shoots springing from near the centre of the stem, the latter appears to have been decomposed at the centre, and the shoot, which may have originated in a layer of soft tissue, has passed radially across three zones of harder and two of softer tissue.

This discovery of Mr. Moss' appears to be a new one in vegetable physiology, as adventitious shoots generally spring from the cambium zone, or directly between the wood and the bark.

## BEDDOME'S FLORA SYLVATICA.

CAN you or any of your readers tell me where I can get a copy of Beddome's "Flora Sylvatica of Madras?" I have written to all the best publishers in India, with the invariable reply that the work is out of print, and "there is no chance of a second edition being brought out."

As this book is the only work on our Madras Flora, it surely would be worth while bringing out another edition, though perhaps a cheaper one, as the last cost nearly Rs. 60 for the whole work, considerably beyond the means of most Forest Subordinates. Dr. Brandis' Forest Flora is almost useless in Madras, and Mr. Gamble's Manual of Timbers is simply what it professes to be, and consequently gives little or no description of trees, and of course none of shrubs, climbers or herbs.

OLD FINCHLEIAN.

*Note.*—Surely Colonel Beddôme's valuable book is in some of the Forest Divisional Libraries in Madras, and thus available for Madras Forest officers.—[ED.]

## III. Notes, Queries and Extracts.

The Timber Acts (Ireland) Amendment Bill.—In the House of Lords on Monday last the Earl Cadogan moved the second reading of the Timber Acts (Ireland) Amendment Bill, and said that its object was to embody all the Acts passed since 1783 for the encouragement of the planting of trees in Ireland in one Act, and to extend the benefits of those Acts to statutory tenants in that country. By the Act of 1783 it was enacted that persons holding leases for lives renewable for ever should have a right to all trees planted by them, and subsequent Acts on the same subject had extended the right to tenants holding for lesser terms. It was now proposed to extend the benefits of those Acts to statutory tenants in Ireland and to those holding under leases of not less than 31 years. A memorandum of the Bill had been circulated stating its objects and its effect, He begged to move the second reading of the Bill.

The Marquis of Waterford was afraid that the memorandum of the Bill which had been circulated was not quite accurate. He thought that it was most undesirable to embody in such a measure as this a number of Acts of Parliament which had been passed in the last century, the effect of which it would puzzle even a lawyer to ascertain. It might some day be discovered that some of those Acts contained germs of a very formidable character. He suggested that instead of those Acts being embodied in the present measure *the Bill should only embody in it the Act of 1783. (Hear,* hear.)

Lord Inchiquin did not think that there was much harm in the Bill, and certainly, if the memorandum were accurate, there could not be much objection to it. He suggested that all the former Acts dealing with the subject should be repealed, and a simple measure introduced for the purpose of carrying out the objects now sought to be attained. He thought that the best course to adopt would be for the noble lord to consent to recast his Bill.

Lord Fitzgerald agreed that it was wholly unnecessary to incorporate all the different Acts on the subject in this Bill, which would merely lead to confusion. In consideration of the difficulty

of the points raised, he had intended to suggest that the Committee stage of the measure should be postponed until after Whitsuntide. If this Bill passed, the rights given should be surrounded with sufficient safeguards. He could not, however, avoid expressing the opinion that legislation of this kind always terminated in paring off some right of the landlords.

The Marquis of Salisbury said that the noble and learned lord had expressed such admirable sentiments as to the attempt to pare down the rights of the landlords, that he could only regret that he was not equally sensitive on the subject when matters far different from the value of oak trees were under discussion.

Lord Fitzgerald—I was not in the House.

The Marquis of Salisbury said that was another cause of regret. During the course of the debate it had appeared that the actual bearings of the Bill were not thoroughly understood, and it had excited considerable disquietude in the minds of many of his noble friends behind him. It would, therefore, be reasonable to put off Committee on the Bill until after Whitsuntide, which would, he hoped, allow sufficient time for the examination of the Bill, and enable noble lords to ascertain that it was a harmless measure.

The Lord Chancellor wished to say that no new rights were conferred by the Bill. The new right created was simply the right which existed under the Timber Acts now in force.

After a few words from Earl Cadogan, the Bill was read a second time.—*Timber Trades Journal.*

## PIGEONS HATCHING OUT A CHICKEN.

My son, wanting some pigeons' eggs to put in his collection, took two eggs from under one of his pigeons; afterwards thinking that *the pigeons seemed very miserable, he put into the nest the egg of* a Brahma fowl; 19 days afterwards the chick was hatched, and the pigeons were very much astonished when the chick got out of the nest and ran about, it was a strong healthy bird, and is now going about with a batch brought out by a hen; and is doing well.

A knowledge that this can be done might be of use to a person who has pigeons, and hen's eggs, that he would like hatched, but has not at the time a hen ready.

A. C.

THE

# INDIAN FORESTER.

Vol. XIV.] October, 1888. [No. 10.

## THE PROPOSED SCHOOL OF FORESTRY AT EDINBURGH.*

My friend, Dr. Hugh Cleghorn, your late President, has done me the great honour of suggesting that I should deliver an address to the members of the Royal Scottish Arboricultural Society at this year's annual meeting. Unfortunately, I am unable to be present, and I therefore thankfully avail myself of my friend's offer, to read at the meeting a few words which I desire to address to the Society. First of all, I wish to express the great satisfaction which my position as an honorary member of the Royal Scottish Arboricultural Society affords me. This great honour was conferred upon me fifteen years ago, while I was holding the position of Inspector General of Forests to the Government of India. At that time it was very gratifying, and I may truly say, it was a source of great comfort, under circumstances which were unusually difficult and by no means always pleasant, to find that my labours in the cause of Forestry were appreciated and recognised by the foresters of Scotland.

I have said that the circumstances under which I worked in India were difficult. You are all aware that India has a civilisation much older than the greater part of Europe; that, while our ancestors, two thousand years ago, were leading a roaming life in the woods, living upon the game they caught, without fields and fixed habitations, a large portion of India was, and had long been, an open, highly cultivated country, governed by powerful kings, with large cities, temples, and palaces, the inhabitants of which had

* By Sir D. Brandis, K.C.I.E., late Inspector General of Forests to the Government of India. Reprinted from the "Proceedings of the Royal Scottish Arboricultural Society," July 1887.

an elaborate system of laws, a system of religion, and a literature rich in poetry. You are also aware that the civilisation of the West, although it commenced at a much later period, has in most respects overtaken and far outrun the ancient civilisation of the East.

When, about thirty years ago, we commenced to take action, in a methodical manner, to place the management of forests in India upon a satisfactory footing, we were confronted with difficulties of a peculiar kind. You have all been accustomed in Scotland, from your early youth, to regard the proprietary rights in waste and forest to be as clear and settled as the proprietary rights in fields and gardens. The boundaries of estates over heath and moorland are as well defined as where they run between farms and houses. In India, on the other hand, the proprietary rights in forest and waste-land had not developed to the same extent as the rights in the cultivated area. In most parts of the country, whether the rulers were Hindus, Buddhists, or Muhammadans, the prevailing idea was that the forest and waste belonged to the ruling power. This idea, however, was by no means general. In some provinces, noblemen and other large proprietors had, in course of time, appropriated all the waste-land and forest; and in other districts, where the system of village communities had become fully developed, the waste and forest, and sometimes a part of the cultivated lands also, were regarded as the joint property of the village community. Hence there was in many cases great uncertainty regarding the first and fundamental question, who is the proprietor of the forests? And the difficulty was increased by the existence of what are called "rights of user" in the forests—*viz.*, the rights which the inhabitants of the neighbouring villages had exercised from time immemorial to cut firewood and timber, to collect grass and other forest produce, and to graze their cattle in the forests. Similar rights of user, as you are all aware, are found, not only in India, but in many forest lands of Europe. In the New Forest, for instance, the largest of the British Crown forests, the Crown has unrestricted proprietary rights in a small part of the area, while of the remainder a portion only may at one time be enclosed and planted, the same being thrown open to pasture and the exercise of other rights by the commoners when another area is enclosed.

The British Government in India, as the guardian of public interests, could not any longer delay action in the matter. It had become apparent to all thoughtful observers that the long period of peace and quiet, brought about by the consolidation of the British power in India, had stimulated the process of clearing the for-

ests for cultivation, so that everywhere forest was disappearing to make room for fields. This steady increase of cultivation was the necessary consequence of the just and good government which India had enjoyed under British rule. At the same time, the consumption of timber was augmented, and the destruction of the forests was intensified by the construction of railways, the building of roads, bridges, and canals; by the erection of public buildings throughout the country, the growth of the export trade and of manufacturing industries, and by the steadily increasing well-being of all classes. Where the forests had not been cleared to make way for the plough, most, and in many places all, accessible timber fit to be used was cut and brought away, to be consumed as fuel and charcoal, to be used for shipbuilding, for railway sleepers, or for house-building. The gradual disappearance of the forests, and the deterioration of those which remained, became alarming, and it began gradually to be acknowledged that action must be taken in the matter. The Indian forest question had been brought before the British Association for the advancement of Science, at the Edinburgh meeting of 1850, and a committee had been appointed by that meeting to study the question, and to submit a report. Of the members of that Committee, two are still alive—your late President, Dr. Hugh Cleghorn, and General (then Captain) Richard Strachey, the distinguished President of the Royal Geographical Society, who, while Secretary to the Government of India, has done more than any one to pave the way for a good organisation of the forest business. Upon Dr. Cleghorn devolved the duty of writing the Report, which was submitted to the meeting of the British Association in 1851.

Previous to this, action had commenced in India in different places. In 1842, Mr. Conolly, the Collector of the district, commenced the magnificent teak plantations of Nilambur in Malabar, which for many years were in charge of a valued member of your Society, John Ferguson, of whose death last year I was grieved to hear. In 1847, General (then Captain) Frederick Cotton drew the attention of the Government of Madras to the Anamalai teak forests, and on his recommendation Lieutenant (now General) James Michael, Companion of the Star of India and an honorary member of your Society, was appointed, in 1848, to conduct the timber operations in those forests. About the same time Dr. Cleghorn, then Civil Surgeon of Shimoga in Mysore, had represented to the civil authorities of that State the evils resulting from the wholesale destruction of the forests through the shifting *kumri* cultivation, by cutting and burning the forest, and it was mainly

owing to his persistent representations that this wasteful system of cultivation was put a stop to in Mysore. In the Bombay Presidency, the late Dr. Gibson was appointed Conservator of Forests in 1847, and in the Tenasserim province of Burma, which had become British territory in 1826, repeated, but at that time mostly ineffectual, attempts had been made to secure the protection of the teak forests. All these are well-known facts, and they have on several occasions been brought before your Society. What is not so well known is, that when it became necessary to reduce these detached efforts to a regular system, so as to secure lasting benefits to the country, the main difficulty was the uncertainty that existed regarding the proprietary rights over the forest ranges of India. The solution of this difficulty, you will readily understand, lies at the root of all good forest management.

After Dr. Cleghorn had for a series of years worked hard as Conservator of Forests of the Madras Presidency, he was called to report upon the forests in the Punjab, which province, as you know, occupies the extreme north-west corner of India. While he was engaged in finishing this duty, we were together at Simla during the summer months of 1863, and he then clearly and fully explained to me the state of the forest business in the Madras Presidency. After discussing the question in all its aspects, we came to the conclusion, that what was wanted there, as well as in other provinces, was to demarcate the State and village forests ; that is, after careful local inquiry, to define the boundaries of the forest areas over which the State, the village communities, and private landowners held proprietary rights. Our views we embodied in a joint-memorandum, and this document was submitted to the Government of Madras. Active measures had at that time been taken in this direction in several provinces—foremost in the Central Provinces, under Sir Richard Temple, then the Chief Commissioner of that territory, who, most of you will remember, in October 1881, gave to your Society a most interesting account of forest conservancy in India. In the Presidency of Madras, however, unfortunately the necessity of action in this direction was not at that time recognised ; and it was not until 1882, when, at the close of my Indian career, I was deputed to Madras by the Government of India, that a Forest law was passed, and that action in the right direction, on the lines of the joint-memorandum submitted by Dr. Cleghorn and myself in 1863, was commenced on a sufficiently large scale. This happy result—the importance of which for the welfare of the people of Southern India cannot be overrated—was accomplished by your distinguished countryman, Sir Mountstuart

Elphinstone Grant Duff, who at that time was the Governor of the Southern Presidency.

What I have said regarding the peculiar difficulties in this respect of forest administration in India, I intend should serve as an introduction to the main subject of my present address. My wish is, on the present occasion, to submit to your Society the views which I have formed regarding the proposal to establish a Forest School in Scotland, a proposal which I desire at the outset to state has my warmest sympathy. What had to be done in India, before the Government could undertake measures for the permanent good management of the forests, was first to determine which areas were the property of the State; and secondly, to free these areas of the customary rights of user with which they were burdened, or where this was not feasible, to define the extent of such rights, and to regulate the exercise of them. This work, which you will admit was indispensable, is in progress in most districts of the vast British Empire, and though it is and must be carried out to a great extent by the Civil and Judicial officers of Government, yet it cannot be accomplished without the co-operation of the Forest officers. Hence you will understand that these gentlemen have to deal with questions altogether different from those with which wood-managers and foresters have to deal in Scotland. And in other respects also the work of a Forest officer in India is very different from that of foresters in Europe.

In the excellent lecture on the Forests of India to which I have already adverted, Sir Richard Temple gave you a true and lively account of the forest fires, which in most districts of India are, and have from time immemorial been, an annual occurrence. The season of spring, when the awakening of the vegetation in Europe gladdens the hearts of men, in most parts of India is the hottest time of the year. No rain, no dew,—the trees in most forests leafless,—grass, herbage, and everything else dried up by parching winds, and by the uninterrupted and relentless power of a fierce and burning sun. The smallest spark suffices to light a fire, which spreads over the grass lands and forests of entire districts. The great injury which these fires do to forests in India, has on several occasions been explained to your Society, and I shall not dwell upon this subject on the present occasion. It was mainly through the exertions of one of my old colleagues, Colonel Pearson, whose name in connection with the Indian Forest Service is familiar to you, that the first effective action on a large scale for the suppression of these fires was taken in the Central Provinces in 1864, where at that time he was Conservator

of Forests. The measures to protect the forests against these annual fires form an important and often very difficult part of a Forest officer's duty in most provinces of India. This work, which during the hot season is extremely laborious and trying to health, is happily not needed in Scotland. Again, in the drier districts of India one of the chief aims of forest management is to increase the supply of fodder for cattle, particularly during seasons of drought. But time presses: I must be satisfied with a bare mention of this most important feature of Indian Forestry, and must give up the idea of entering further into this branch of the subject.

The main point of difference between the work of a forester in Scotland and that of a Forest officer in India, consists in the vast area of the Indian forests, and in the magnitude of the operations involved in the management of these estates. You are aware that those forests in the British Indian Empire, which are the property of the State, and which have been either freed of customary rights of user, or in which these rights have been defined and settled, are called "reserved State forests." There are other forests, over which the Government exercises a certain control, more or less effective according to circumstances, but on the present occasion I shall limit myself to the reserved forests. Well, their area, according to official documents, on the 1st April, 1885, amounted to nearly 50,000 square miles, or 32 millions of acres, all the property of Government, and managed by Government officers. You will at once understand that for the protection and management of so large an area, a very large staff of officers, numbering many thousands, are employed, and that nearly the whole of these are and must as a matter of course be Natives of India. Among these again there are, as you can readily imagine, superior and subordinate officers, and in order to give candidates for the superior Native forest service the needful professional education, a Forest School was established in 1878 at Dehra Dún in Northern India. Of this Forest School I am glad to see you have in the last volume of your "Transactions" an excellent account by Colonel F. Bailey of the Royal Engineers, who, after having organised the Indian Forest Survey, became the first Director of the School, and Conservator of the extensive forests attached to it for the practical instruction of the students. At this school, my former colleagues tell me, there are now about 60 young men from all parts of British India, Hindus, Muhammadans, Buddhists from Burma, and Native Christians. Only a comparatively small number of the highest appointments are filled by men sent out an-

nually by Her Majesty's Secretary of State for India. The number of these appointments is, I am informed, now about 170, and it is not intended considerably to increase it. Although these officers sent out from home are on arrival in India, in the first instance employed in subordinate positions, yet when they have become familiar with the language and the peculiar work in India, they are destined to fill the highest appointments. Hence a most important part of their work consists in directing a large staff of subordinate officers. From among them are selected the chief Forest officers in the different provinces, the officers charged with the preparation of working plans, and the Professors of the Forest School. With them rests, and must generally rest, the initiative in professional matters, and any mistakes made by them may have a far reaching and very mischievous effect. You will readily understand that they ought to be picked men, thoroughly familiar with the science and practice of forest management in Europe, and with the experience gained in forest administration in those countries, where it is best understood, and where it exists on a large scale analogous to what we find in India.

Now I will direct your attention to the manner in which forest business is managed on the Continent of Europe. In the kingdom of Prussia, for instance, the area of the State forests alone amounts to 6,600,000 acres. More than twice this area is in the hands of towns, villages, public corporations, and private individuals. The whole of the large forest area of Prussia,—upwards of 22,000,000 acres,—is managed on a regular system, with the object of maintaining a uniform annual yield in wood, timber, and other forest produce, the amount of which over a large portion of the area is slowly increasing every year, as the result of the steady improvement which takes place in the condition, and, consequently, in the productive powers of the forests. The number of the superior officers entrusted with the management of the Prussian State Forests is 807. As regards their duties, they correspond in India to the superior Native staff, who receive their professional education at Dehra Dún, and the staff recruited by the officers whom the Secretary of State for India sends out. The professional education of the superior Prussian Forest officers is organized thus: After passing the closing examination at one of the large German public schools, the candidates go through a practical apprenticeship of one year in one of the State forest districts, and after studying for two years at a forest school, and one year at a university, they may present themselves for their first examination, which, like all others for State service in Prussia, is a pass, and not a competitive examina-

tion. A high standard is fixed, which must be attained. The next step is to spend two years in practical work in several forest districts, after completing which the candidate presents himself for his second or final examination, which, like the first, includes all branches of forestry, the questions asked having, however, more special reference to the actual requirements of the service, than was the case at the first examination. The closing examination at the public school is generally passed at the age of 19, so that, allowing one year for military service, and six months for the two examinations and the unavoidable delay connected therewith, the candidate will have attained the age of 26 or 27 by the time he has passed the final examination. He then receives the designation of *Forst Assessor*, and is eligible for employment in the State forest service. Government, however, is in no way obliged to find employment for passed candidates, and as a matter of fact, few obtain a permanent appointment in the lowest grade of the superior Staff, which is that of Oberförster, before they are considerably past the age of 30, while those who do not find such employment seek appointments in forests belonging to towns and villages, to public corporations, or private proprietors. In other German States the arrangements are similar to those just described. There are local peculiarities, but the principle is the same; everywhere a thorough and prolonged professional training, partly practical, partly theoretical, is required of candidates for the superior State forest service.

I do not apologise for claiming your attention so long for the organisation of the Forest Service in Germany. You will presently see that it has a direct bearing upon subjects in which you are specially interested. My experience has taught me, that young Englishmen, Scotsmen, or Irishmen are, by constitution and habits, admirably fitted to make first-rate Forest officers. Nevertheless, on the first occasion, when I had an opportunity of carrying the point, which I long had in view, I requested the Government to permit me to select two German Forest officers for service in India, who had passed all examinations for the superior State forest service. This was in 1866. I took the greatest possible pains in this business, was favoured by circumstances, and was most fortunate in my selection. What I wanted were men as young as possible, who had successfully passed the prescribed course of professional training similar to that which I have just described to you. It thus happened that they were not Prussians. Dr. Schlich, who succeeded me as Inspector General of Forests when I left India in 1883, was a native of Hesse Darmstadt; and Mr. Ribbentrop, who is now act-

ing in the same appointment while Dr. Schlich is employed at Cooper's Hill in starting the Forest School, at which, as you are aware, candidates for the Indian Forest Department are now educated, was a native of the former kingdom of Hanover, which in 1866 had just been annexed to Prussia. The fact that the Government of India have selected these two men for the important appointments which they now hold, and that for these appointments they have been preferred to many Forest officers in India of great ability and experience, shows, that the thorough professional training which Dr. Schlich and Mr. Ribbentrop had received in their own country, had been most useful to them in India, and that its value has been fully recognised by Government. It is, as you may readily imagine, a source of great satisfaction to state these facts to you, and I venture to hope, that some day it will be carefully considered, whether those Indian Forest officers, who are destined for the highest appointments in that country, ought not to receive a professional education as thorough as the candidates destined for the superior staff of the Prussian forest service. The time allotted to their studies at Cooper's Hill is two years, while the time allotted to their professional studies under former arrangements on the Continent of Europe was two years and eight months only. The time was not fixed so short because that was considered as sufficient, but because it was and is not, I believe, at present deemed possible to assign a longer period or to organise the whole business in a different manner. The professional education of Forest officers in Germany has not always been as elaborate and as prolonged as it is at present. In every country these are matters of gradual growth.

But good and really effective forest management is of vital importance for the welfare of the people of India. We, all of us, who had anything to do with the growth of forestry in that country, started with the provision of a lasting and, if possible, steadily-increasing supply of timber, wood, bark, and other forest produce as the aim and object of forest management, and, in addition, we hoped that by improving the forests on the hills the water-supply for irrigation would be better regulated, that inundations and the silting up of rivers would be diminished, and the like. At a later period experience taught us that in certain parts of India, the sufferings caused by drought and famine might be somewhat mitigated by increasing the production of cattle fodder in the forests. And within the last few months it has been established beyond doubt, that in the Central Provinces the protection of the forests has already had an appreciable influence upon the rainfall. This had long been hoped for by enthusiastic foresters in India, but

there was no proof for it. This proof has now been obtained, and I may add that I owe this most important information to the highest living authority on the subject,—to my friend, Mr. H. F. Blanford, the Meteorological Reporter to the Government of India. Deficient rainfall means famine in India, and we may therefore hope that the improvement of forests on a sufficiently large scale in certain parts of the country will to some extent tend to diminish the risk of drought and famine.

You will readily understand that with these important interests at stake, every effort ought to be made to steadily improve the professional training of the Forest officers sent out to India from Great Britain. I shall not enter further into this subject, which, though of paramount importance to India, is not of such special interest for the members of your Society. But what I desire to say is this, that the requirements of wood-managers and foresters in Scotland are entirely different from the requirements of Indian Forest officers. It does not follow that in special cases, foresters, who in Scotland have learnt their profession in the empirical manner hitherto customary, could not work their way up to the higher ranks of the Indian Forest Service. There have been many instances in India which show that under the guidance of good officers, and otherwise under favourable circumstances, men can make up, by means of industrious study, and of steady hard work, for their deficient professional education at the outset. Indeed, as explained to you in Colonel Bailey's excellent paper on the Indian Forest School, to which I have already adverted, the bulk of the work in the first organisation of Indian forest business was successfully accomplished by men who had not received any special professional training. This, however, was in the beginning, when forest work in India had more of an administrative than of a professional character.

As further progress is made, this will change, and new problems of a professional character will present themselves, which will tax to the utmost the special knowledge and the skill of the forester in India.

My advice in this matter is, to keep the two undertakings entirely distinct, the elaborate professional and scientific training of those who aspire to appointments in the superior forest staff of India, and the establishment of forest schools for wood-managers and foresters in Scotland, England, and Ireland. In Prussia and other countries of the Continent of Europe, the State is the largest forest proprietor ; moreover, it is justly held to be the duty of the State to watch over the good management of the forests which belong to towns, villages, and public corporations. In

these countries, therefore, it clearly is the business of the State to organise the system of forest instruction. It is different in Great Britain, where, out of a total area under timber of about 2,800,000 acres, the Crown has only about 100,000 acres, while the rest belongs to private proprietors. In the United Kingdom the condition of things is similar to that which exists in some parts of Austria, notably in Bohemia and Moravia, where the large forest proprietors have formed two Associations for the purpose of providing professional education for young men, who desire to enter their service as wood-managers or foresters. The professional education for the State forest service in Austria was considered too high and too expensive for the requirements of these private estates; the proprietors therefore determined to help themselves. The Bohemian school at Weisswasser was established in 1855; students are required to pass through a middle class school, and to serve a practical apprenticeship of twelve months, after which the course of studies at the school occupies two years, A forest district of 2,900 acres, the property of Count Waldstein Wartenberg, is attached to the school, and placed under the control of the Director for purposes of practical instruction. The Director, Chevalier Fiscali, is a distinguished forester, and under him is a staff of five professors, one for those branches of forestry not taught by the Director himself, one for mathematics and surveying, two for natural sciences, and one for drawing and book-keeping. Eulenberg, the school maintained by the Association of Forest Proprietors of Moravia and (Austrian) Silesia, was founded in 1851, and has a similar organisation. No fees are paid by sons of foresters.

Ever since I heard of the plan to establish a forest school in Scotland, I have been of opinion, and have given expression to this opinion whenever I have had and opportunity, that as soon as the desire gains ground among proprietors in Scotland to obtain for their estates the services of wood-managers and foresters who have received a more systematic professional training than is attainable at present, they will find the needful means and take the needful steps for the establishment of a forest school. It clearly is their interest to increase the annual yield, and to improve the productive powers, which means the capital value, of their estates. These ends may to some extent be accomplished by a more systematic management of their woodlands, and this again will doubtless be promoted by giving to foresters a more systematic training in their profession than they receive at present. I am, however, fully aware, that there are two circum-

stances which, to some extent, may impede the speedy accomplishment of this idea—the low price of timber, and the very high rent at present obtained by the letting of grouse moors and deer forests. Of these two circumstances, however, the members of this Society are much better able to judge than I am, and I do not therefore attempt to discuss them.

The natural and proper thing in the present case, is for the proprietors to take action on their own account. Should this, however, not be the case, and should the Royal Scottish Arboricultural Society feel themselves strong enough to take the initiative in such an undertaking, this would be an excellent and most important step in the great and good work which your Society has steadily pursued since its formation in 1854. Your aim from the commencement has been, *to raise forestry in Scotland to the dignity of* a profession. Your "Transactions," the prize essays published by your Society, the excursions to instructive forest districts, the great International Forestry Exhibition at Edinburgh, and the lectures delivered under the auspices of your Society, have all been important steps in the same direction. If the Royal Scottish Arboricultural Society should find itself to be in a position to take the lead in this great movement, the large landed proprietors might perhaps afterwards be disposed to take up the scheme and to work it out on their own account. Something of this kind happened at Weisswasser, which was at first established by the Bohemian Forest Society, and which was thus continued until 1862, when the forest proprietors of the province took over the institution.

In whatever manner the scheme of establishing a forest school for the professional training of wood-managers and foresters may be accomplished, I desire to assure you of my hearty sympathy in the undertaking. In some excellent remarks, headed, "How to make the most of the Excursions arranged by the Society," your honorary member, William M'Corquodale—with whom in 1865 I spent a delightful and most instructive day in the woods of Scone Palace, near Perth—justly drew attention to the advantage of an accurate study of the methods of forestry practised on various estates. Much, very much, of the highest interest to the forester, may be seen and learned in the Scottish woodlands. Different methods of forestry have been practised under widely different circumstances, in some cases with marked success, while in other cases there have been failures. A forest school, if the teaching is of the proper kind, will contribute much to a better understanding of the circumstances which have led to success in the one case and to

failure in the other. The students will be taught to observe accurately, to combine their own observations with the theoretical knowledge they have acquired, and this will eventually enable them to draw correct conclusions from the facts which they have observed. The school, if well directed, ought to become a centre of scientific research, the results of which will contribute much towards a more successful management of the woodlands. The foresters trained at the school will not only be more efficient in their work, but—and this is of very great importance—the better they learn to understand the connection, as worked out by science, between cause and effect in the life of trees and shrubs, the greater will be their enthusiastic attachment to their profession. True, healthy, enthusiastic attachment to one's profession is a blessing in the life of a young man, the value of which it is difficult to overrate. When the time for action comes in the matter of the Scottish Forest School, I shall deem it an honour and a pleasure, if it should be desired, and if circumstances should permit, to help with my advice, and some day, perhaps, to explain to the students some of the conclusions which I have formed as the result of many years' study of trees and shrubs in different countries.

## A NOTE ON THE APPARATUS REQUIRED FOR COLLECTING INSECTS IN INDIA.

*Killing bottle.*—A simple and effective killing bottle is made as follows :—

Two or three lumps of cyanide of potassium, each as big as an acorn, are dropped into an empty quinine or other wide-mouthed glass bottle : enough plaster of Paris, made by mixing the dry powder with water to the consistence of cream, is poured in to cover up the lumps of cyanide. The bottle is left open for a few hours, until the plaster has set hard, when it is tightly corked up, and after remaining closed for a day or two, is ready for use.

The plaster and cyanide set into a solid mass, which sticks fast at the bottom of the bottle, the object of the plaster being to hold the cyanide in place, and the whole mass has a smooth, even surface, from which insects can be easily picked up, the glass sides of the bottle enabling the insect to be easily seen.

A few minutes in a good killing bottle, thus made, is sufficient to kill most small insects, but some of the larger species of insects require to be kept in it for several hours to insure their not reviving.

A killing bottle, when carefully used, should last for a good many months, the great thing being to keep it tightly corked up and always to close it quickly, after taking out or putting in an insect, thus allowing as little as possible of the cyanide vapour to escape.

Old quinine bottles do very well for all ordinary purposes, as killing bottles, they are cheap and of a convenient size, but are not big enough to take the largest moths and beetles, so for these a larger size of bottle should be obtained.

*Killing butterflies.*—All insects can be killed in a killing bottle, but for butterflies it is quite sufficient to fold the wings together over the back, and then to pinch the thorax between the finger and thumb ; this kills the insect without injuring its wings.

*Preserving insects in alcohol.*—Eggs, pupæ and soft-bodied insects, (such as caterpillars and grubs,) can be at once killed and preserved by dropping them alive into strong alcohol, where they do not putrefy or shrivel up, as they would be liable to do if it were attempted to dry them.

*Small insects.*—All small insects, when taken out of the killing bottle, should be at once pinned, or else gummed on to little pieces of cardboard or mica, great care being taken in gumming them not to smear the gum over their bodies ; the little bits of card or mica can be pinned down into cardboard boxes, and thus closely packed to travel.

*Medium sized insects.*—Medium sized insects (including all butterflies and most moths) can be wrapped in soft paper, when they come out of the killing bottle, and as soon as they are dry, can be packed lightly but closely together into tight-fitting tin boxes, with a few lumps of camphor or naphthaline ; in this way they can be sent long distances by post without fear of injury. Simply drying the packets, which contain the insects, separately in the sun and air for two or three days being quite sufficient to preserve their contents.

*Large insects.*—Large insects, especially those with stout abdomens, require to have the contents of the abdomen removed, and the shell stuffed with cotton wool, after which they can be dried and packed like the medium sized insects above.

*Keeping dried insects.*—All insects, when thoroughly dried, can be kept in any close-fitting box or case which contains a little camphor or naphthaline. It is essential, however, for the case to be itself perfectly dry and practically air-tight.

*Insect net.*—A simple and serviceable net for catching insects can be made out of mosquito curtain stretched on a cane hoop with a bamboo handle attached.

*Forceps.*—A pair of forceps, which can generally be made locally, will always be useful for picking up small insects.

*On sending insects for determination.*—In sending specimens of insect pests to entomologists for determination : each pest should be kept carefully by itself, and when possible specimens should be sent, in all stages of development and in considerable numbers, accompanied by any notes on the habits of the insect and a full account of the nature and extent of the damage, also any specimens (such as half eaten leaves, bored wood, damaged grain, &c.,) which throw light on the nature of the attack.

Live specimens are always easier to make out than dead ones, so they should always be sent when there is a reasonable probability of their surviving the journey ; chrysalides and cocoons, especially, should be sent alive, packed in a perforated box with leaves or grass.

So little is at present known of Indian entomology, that the exact determination of species is often a matter of very great difficulty. Hence the necessity of furnishing full particulars and also of collecting a considerable number of specimens in each case, as these are often of great assistance in making out the affinities of an insect, and in any case form a most valuable record for comparison.

*Materials.*—The following materials are sufficient for collecting a vast number of insects, and would probably last one collector for at least a year.

In the absence of price lists, it is impossible to say what the exact cost would be, but from Rs. 5 to 20 would probably buy all that could possibly be wanted by one collector.

For collecting ordinary dried insects the following will be sufficient :—

Four ounces of cyanide of potassium.

A pint bottle full of dry plaster of Paris.

One pound of camphor (or better naphthaline).

A couple of wide-mouthed bottles with corks.

Three yards of mosquito net.

A few pieces of cane and bamboo.

Some small tin boxes.

A packet of thin white brown paper.

A pair of forceps.

A needle and thread.

A ball of string.

A yard or two of mulmul.

A pocket knife.

If larvæ and other soft-bodied insects are to be collected, the following should be added :—

One quart of strong spirit (or better pure alcohol).

Same empty bottles with corks.

A little wax for closing bottles.

If very small insects are to be collected, the following should also be provided :—

Two or three sheets of fine cardboard.

Two or three packets of small pins.

An ounce of gum arabic.

Small cardboard boxes of various sizes.

*Rough collecting.*—The above list contains all that is likely to be wanted by a collector ; but a great deal can be done with very much simpler materials ; for instance, when other apparatus is not at hand, any insect can be killed and preserved by dropping it alive into a bottle of alcohol (or even whisky), though its colours will always be more or less damaged in the process, and it will consequently not make a good cabinet specimen afterwards.

*14th September*, 1888. E. C. COTES.

---

## COMPENSATION UNDER FOREST ACT FOR ILLICIT FISHING.

I UNDERSTAND that the draft of a new Forest Act is being considered at Simla, and as not even the wisest amongst us can grasp all the points in which the present Act requires amendment, will you permit me to add my little quota ? In 1881, fishing with nets was prohibited within the reserved forests of the School Circle, North-Western Provinces, and the punishment for contravention of this rule fell under Section 25 (*i*). It was not always advisable to send such cases to a Magistrate, and in consequence Section 67 was resorted to in dealing with them.

Some years afterwards the Local Government passed certain orders regarding the amount of compensation leviable, and the maximum was fixed at ten times the value of the produce in all cases dealt with under Section 67. Time went on and it was discovered that to take even the maximum compensation in fishing cases did not act as a deterrent, because the value of the fish

caught, was in most cases so small. Application was then made for Forest officers to have the power to confiscate the net, obviously the best punishment in addition to a small fine. On this application the Local Government has just passed orders—(1), that it is not advisable that any exceptions should be made to the law (regarding confiscation) as at present constituted ; (2), that fish do not come within the definition of forest produce, and that (3), subject to a maximum of Rs. 10, the Forest officers will assess the value of the nets or tools which would be liable to confiscation had the case gone before a Magistrate, and to this they may add a further sum on account of damage (if any) proved to have been committed.

Now when a man fishes illegally in the streams of the Dehra Dún Division, he commits no assessable damage whatever ; the value of the small meshed circular cast net he uses is about Rs. 3 ; he may catch Rs. 3 to Rs. 4 worth of fish, which he sells, hence according to the latest orders of the Local Government, the man practically gets off scot free. When fish was considered forest produce (as it most certainly is, just as much as shells, bones and horns), and we were empowered to take up to ten times the value of the produce, the punishment was in some cases sufficient ; but now it is in all cases insufficient.

What is required here is power to confiscate the net. It will at least take the offender some time to make a new net, and meanwhile the fish will have rest ; but as matters stand at present under the latest orders, it will be worth while for a man to net regularly ; for once he is caught, he will escape detection ten times, and make a good living out of it. The only remedy is to send all such cases to a Magistrate, simply in order that the net may be confiscated ; and this I shall take care to do in future.

Let us hope that in the amended Forest Act, if there is to be one, fish may be classified as forest produce, and that Forest officers may have power to confiscate the nets.

A. Smythies.

THE

# INDIAN FORESTER.

Vol. XIV.] November, 1888. [No. 11.

## REPORT ON THE BETTER CONSERVANCY OF FORESTS ON HILLS SURROUNDING MOUNT ABU.

*By* BHAI SADHU SINGH, *Forest Ranger, Jeypore.*

### GENERAL OBSERVATIONS.

**Situation and configuration of Abu.**—Mount Abu is situated near the centre of Serohi, a Native State, which forms the north-west portion of Rajputana. It is an isolated, precipitous granite mountain, with a good many steep peaks and ridges. The highest peak, named Guru Shikar, is 5,650 feet above the level of the sea. The elevation of Abu sanitarium is 5,000 feet. The circumference of the base of Abu is said to be 48 miles. The surrounding plains are generally open and level, though in places rather uneven and wild. The hilly tract to the east of Abu, as far as the Aravalli Range, named Bhakhar, is some 30 miles by 24 miles in extent, while towards the west, we see the much more level and cultivated plain.

**Geology of Abu.**—As regards the geology of Abu, the remarks of Mr. W. F. Eden will be found interesting: "The Mount Abu is not connected with the Aravallis, but is separated on the north by a few low hills, and on the east by the large plain of Rohera. It seems as if the mountain had originally been a series of peaks and ridges, separated by deep rocky defiles, which by the disintegration of the rock and the action of the elements had become filled up to a greater or less extent. For when wells are dug, it is not unfrequent to meet with clay, gravel, or rocks, more or less disintegrated as the workman passes downwards. Sometimes very fine specimens of rock crystals of large size are found. The vast mass of the hill is granitic, but occasionally within the boundary range of peaks, metamorphic trap, basalt and other varieties of the same gneiss may be recognized, as also other stratified transitionary rocks. On the eastern face of the hill the upper

parts are all granite, but as the plain of Rohera is approached, about one-third of the elevation inclines at an angle of about 75 degrees towards the horizon and dips downwards towards the west. On this face of the hill is also found a quarry of white marble, of which, it is said, the famous Jain temples on Abu were built. Earthquakes more or less marked are still frequent."

**Soil, &c.**—The soil being fertile and rich, is naturally covered with jungle in hills as well as to a great extent in the plains. But the peaks and ridges of the sanitarium have been nearly denuded, owing to the continued and indiscriminate cuttings that have been going on for the past 30 or 40 years, while in the plains the jungle is gradually diminishing to some extent, as the cultivation is increasing with the increasing population and the change in the mode of life. The inhabitants of the State now frequently come in contact with men from other provinces, and even with Europeans, whose number for visiting the Delwara temples, or Abu sanitarium is steadily increasing, and have been thus placed in a position in which their wants and aspirations are undoubtedly rising. Great facility having been afforded them for exporting ghí and minor forest produce, as well as grains, they pay particular attention to pasturage and agriculture. Thus the gradual diminution of jungle is certain, as is evident from the following facts, *viz.*, that the revenue of the State, which is mainly the land revenue, has increased from 1¼ to 1¾ lakhs during the past few years.

*Rainfall, &c., at Abu during the last* 15 *years.*

| Year. | Average Barometer. | | | Average Thermometer. | | | Rainfall in the year. | Remarks. |
|---|---|---|---|---|---|---|---|---|
| | Maximum. | Minimum. | Mean. | Maximum. | Minimum. | Mean. | | |
| | | | | | | | inches. | inches. |
| 1870-71 | 25·94 | 25·72 | 25·83 | 84 | 54 | 70 | 51·97 | 26·59 in July. |
| 1871-72 | 25·875 | 25·648 | 25·776 | 78 | 61 | 69·7 | 56·33 | 29·69 in August. |
| 1872-73 | 25·827 | 25·624 | 25·746 | 78 | 63 | 70 | 60·15 | 26·79 in „ |
| 1873-74 | 25·77 | 25·55 | 25·65 | 89·1 | 55·6 | 70·3 | 34·26 | 14·96 in July. |
| 1874-75 | 25·80 | 25·5 | 25·7 | 84 | 55·5 | 68 | 72·29 | 28·17 in August |
| 1875-76 | 25·70 | 25·64 | 25·67 | 78 | 61·4 | 69·6 | 110·30 | 50·90 in September. |
| 1876-77 | 26·209 | 25·94 | 26 076 | 79·2 | 56·1 | 67·6 | 45·25 | 19·63 in July. |
| 1877-78 | 26·134 | 26·046 | 26·096 | 79·8 | 62·37 | 71·09 | 19·29 | 5·06 in „ |
| 1878-79 | 26·107 | 26·046 | 26·075 | 78·8 | 71·7 | 70·4 | 72·79 | 33·52 in August. |
| 1879-80 | 26·006 | 25·932 | 25·973 | 76·7 | 62 | 68·9 | 68·62 | 41·04 in „ |
| 1880-81 | 26·135 | 26·073 | 26·104 | 76·9 | 61·5 | 69·2 | 49·32 | 20·12 in „ |
| 1881-82 | .. | .. | .. | .. | .. | .. | 98·42 | 47·88 in July. |
| 1882-83 | 25·952 | 25·887 | 25·919 | 76·92 | 62·1 | 68·81 | 58·58 | 38·12 in „ |
| 1883-84 | 25·956 | 25·989 | 26·174 | 76·5 | 61·5 | 68·6 | 52·95 | 25·13 in „ |
| 1884-85 | 26·041 | 26·078 | 26·114 | 74·6 | 59·6 | 66·8 | 105·36 | 41·96 in „ |

**Rainfall in Abu hills.**—The above statement shows that the rainfall on Abu is very uncertain—while in 1877-78 it was only 19·29 inches, in 1875-76 it was as much as 110·30 inches; the maximum of rainfall being in July and August. As a rule, March and April chiefly, January, February and October generally, November and December occasionally, and May, June, July and August are hardly ever without some rain. The uncertainty of rainfall on these hills affects agriculture in the plains to a considerable extent, as is evident from the fact of now and then, the crop getting remarkably short, fodder scarce, the grass scanty and the people suffering miserably in consequence.

**Forest growth.**—The forest growth varies according to elevation and soil. Along the foot of the hills, as well as in the plains, *Butea frondosa, Acacia Catechu, Acacia leucophlœa, A. rupestris, Prosopis spicigera*, &c., &c., are generally met with. But ascending further up we see *Ulmus integrifolia, Sapindus emarginatus, Ægle Marmelos*, bamboos, *Cratœva religiosa, Nauclea parvifolia, Sterculia urens, Boswellia thurifera, Diospyros Melanoxylon*, and some species of *Albizzia, Anogeissus, Zizyphus* and *Bauhinia*. Near the summit are found *Eugenia Jambos, Mangifera indica, Mallotus philippinensis, Cryptolepis, Buchanania, Casearia tomentosa, Anogeissus latifolia, Cæsalpinia Sepiaria, Ficus cordifolia, Flacourtia sapida, Ficus bengalensis, Ficus Wightiana, Ficus religiosa*, as well as *Dalbergia latifolia* and many others. Palm trees are confined to a few places only. As I stopped at Abu only for a short time and when the monsoons had commenced, a complete list of the species growing in the hills, with authentic local names, could not be prepared.

**The inhabitants.**—The inhabitants of Serohi are Bhils, Minas, Grassias, and Kolies, with Rajputs as their ruling race. The population of the State is said to be 55,000, or 18 persons per square mile. The plains of course are more populated than the mountains, as the facility for keeping herds of goats, sheep, and cattle, and that for cultivating land is more there than in the precipitous hills of Abu. The ryot is illiterate, uneducated and backward in civilization, consequently the majority of them are in poor circumstances.

**Land tenure.**—About three-fourths of the State is said to be in the possession of Rajput Thakurs, who give half the produce in kind to the Ráj; but I am told that the surrounding hills of Abu station are khalsa (or crown land), in which no Jagirdar, &c., has any right. These hills are principally inhabited by the Bhils.

**Wealth of the people.**—The wealth of the people chiefly con-

sists in flocks and herds. The villagers pay nothing for grazing or for fuel, timber or any other forest produce taken from their respective village lands, for *bonâ fide* household requirements. They can sell fuel by head-loads, free of all charges, but in case of fuel or timber removed for sale by carts, &c., they have to pay a certain rate to the State. Some of the minor forest produce, such as honey, is sold only to the Ráj at fixed rates. There is room in this direction for the people to extend their profits by paying more attention to the subject.

Mr. McKee, in the "Indian Forester" for October 1883, states that the revenue from *lac* in Rewah State has in recent years incresed from Rs. 12,000 to Rs. 52,400, while formerly when the extraction of lac was not sufficiently known in Rewah it amounted from this source merely to Rs. 500 per annum. He adds that the people of Rewah are at present well acquainted with the process of extracting lac, and are thoroughly conversant with the habits of the insect, the method of propagation, and the treatment of the trees employed. He is of opinion that "Kala chilla," a variety of *Butea*, yields more lac than "Sufed chilla." Both of these varieties grow side by side in Rewah. Now there are a good many *Butea* trees here in Serohi, and an experiment is therefore worth trying to get lac from them. If the existing chilla does not give lac, the other kind of chilla may be introduced to good purpose. In Sawaie Madhopur of Jeypur State, gum is obtained by tapping the *Butea*. Similarly other experiments for obtaining minor forest produce may be tried in the interest of the State. In short, this subject is worth careful consideration.

**Walar cultivation.**—The jungle being valueless in the opinion of the people, a sort of forest-destroying cultivation is practised by them, notably by Grassias, a nomad tribe. They clear out large patches of forest land, and set fire to what they have recklessly cut down, without paying any regard to the useful trees, or the protective undergrowth. They use the ashes as a manure in their roughly prepared fields, in which they raise crops once, or twice, until the productive property of the soil is injured, the surface soil being either caked, or washed away, and the fields eventually turned into a mere scrub of weeds or bushes. The kind of cultivation above mentioned is called "*Walar*" in this locality, and requires gradual suppression, as it is neither profitable to the people nor the State. At any rate it requires every discouragement at Mount Abu, specially within some five miles of the sanitarium, where the Bhils are a little advanced in this respect, as they do not burn good trees for this purpose.

**The wood supply of Abu station.**—The fuel supply of Abu is chiefly by head-loads, mostly brought in by Bhils. The orders concerning this supply are, that nothing but dry wood should be brought in, but I have heard from trustworthy sources, that a great deal of green wood, principally underwood, is generally mixed with the dry, through want of careful supervision. The dry wood is allowed to be brought in from any place where it can be had, and wood being scarce near Abu, the Bhils generally bring it from a distance of two or three miles. Most of the local Bhils live by the fuel supply and sundry service to the visitors and residents of the sanitarium. Fuel and charcoal for Government troops are brought from the Nadra forest lands, situated on the western margin of Abu, outside the sanitarium. The supply is managed by a contractor. He purchases wood from the State, gets a portion made into charcoal by giving out petty contracts, and the charcoal as well as the wood he brings to the station by the same means.

## REASONS FOR CONSERVANCY AT ABU.

**Abu Sanitarium.**—Abu is a place remarkable on account of the sanitarium for the Bombay troops and the head-quarters of the Rajputana Agency, as well as for the Lawrence School and the famous Jain temples, situated in Delwara, a part of the station. There is a small lake in the *station, conveniently situated.*

As far back as the year 1863, the population was only 1,200, but it has steadily increased since that time, and at present it is approximately estimated at 2,000 persons. The number of European gentlemen visiting the sanitarium has increased to about 60 per annum, and the number of native visitors, including pilgrims, to the renowned temples of the Jains, has increased during this period approximately from 1,500 to 8,000 per annum. The number of bungalows may be approximately put down at 100, with a larger number of quarters for servants and various petty houses in the bazaar. There are barracks for some 200 European soldiers. To meet the necessary demand for timber and firewood specially in a hill station, where constant repairs to buildings are necessary, and moreover a considerable quantity of fuel is required in the winter, the suppliers of wood have cut down trees indiscriminately during the last 30 or 40 years, wherever they could find them within a convenient distance. Consequently, the soil by heavy *rains* specially in steep places, has been considerably washed off, and the hard rock laid bare in many places. Thus the surrounding hills of Abu sanitarium have been almost denuded,

and the fuel and fodder supply fallen short, not to speak of the change in climate. Notwithstanding frequent injuries, a few trees with fair growth of underwood still remain. If this vegetation is for a certain period protected, even the steep and almost denuded rocks in the surrounding hills will, in time, recover. Besides these hills, the remote ridges and peaks of Abu hills are similarly steep and precipitous, consequently not suitable to extensive agricultural operations. The rain water falling on these steep hills of about 75 degrees, rushes down with great velocity, carrying down all disintegrated rock which comes in its course, flooding the ravines in the plain for a short time and then subsiding. As the banks of water-courses and streamlets, as well as the sides of the more remote hills, are fairly covered with forest vegetation, which breaks the force of the rainfall, and makes the rocks firm by means of its roots, the destructive torrents are prevented. This check in the course of torrents, is chiefly appreciated when we consider that the water being everywhere near the surface in the plains, and the soil being rich, as also there being a sufficient number of men in the State, there is every prospect for the extension of cultivation in the plains. As the country is now opened out by the railway, the increasing prosperity of the tenants will certainly provide them with necessary funds for extending agriculture. In short, to preserve the salubrious climate of the station, and to reduce the present high rates for fuel, fodder, and timber supply to the place, as well as to assist in the regularity of rainfall and to minimise sudden floods in the plains, it seems most desirable that the conservancy of forests on the hills in general, and that of the denuded ridges and peaks of the sanitarium in particular, should be brought under better management. An adequate area of forest outside the station, and conveniently situated for the purpose of supplying fuel and timber to the place, may be selected and placed under special treatment for the continuity of its produce. Besides this, the area extending to 300 yards on both sides of the main roads coming to the sanitarium may be specially protected to prevent landslips, as well as to afford agreeable cool air to the travellers who come to visit the station in summer.

## PROPOSALS FOR THE BETTER CONSERVANCY AT ABU.

**Proposals.**—For the sake of convenience I have divided the proposals into four parts, *i.e.*, (*a*), those relative to the area within

the radius of 5 miles from the Abu church; (*b*), those relative to the area extending to 300 yards on both sides of main roads to Abu sanitarium; (*c*), those relative to an adequate area selected outside the Abu station with the view to supply fuel and timber; (*d*), the area of the hills outside the above selected places.

(*a*). *Proposals relative to the area within the radius of 5 miles from the Church at Abu.*

**Selection of Areas.**—The fifth is perhaps the last mile where denudation has reached, but if operation to that distance be considered unnecessary, the limit may be put down to the fourth mile. Within this area, there are ridges and peaks which can be conveniently protected and brought under cultural operations. All such available ridges and peaks may be taken up where rights and privileges either do not exist, or can be easily compensated for, without much inconvenience to right-holders. Care may be taken that they are to some reasonable distance from habitable quarters. The plain portion of the plateau may be left out, as among other things, grazing lands for an adequate number of cattle to supply milk, &c., to the residents, is a necessity.

**Demarcation.**—The selected areas may be demarcated by kucha masonry pillars, conical in shape, 6 feet in diameter at the base, and 4 feet in height. Such pillars cost in the Murree forests of the Punjab only 8 annas each, white-washing inclusive. The average distance between these pillars ought to be quarter of a mile. They should be placed in conspicuous places, so that they may be clearly seen at a distance.

**Fencing.**—It is expected that the boundary lines of these selected areas will generally run along steep places, but in cases where cattle trespass is probable, rubble masonry walls, 3 feet high and 2 feet thick will be necessary. The average cost of such walls in Ajmere has been Rs. 2-4 per 100 running feet.

**Sowings.**—Sowings of indigenous trees may be extensively tried early in the rains. The seeds should be sown by dibbling them in contour lines in favourable places where good soil exists. The operations should commence from top side, gradually extending down to the base of the demarcated area. Seeds of foreign species should not be sown unless their cultivation and chances of success are well studied in a nursery.

**Planting.**—Planting is expensive, but to a limited extent attempts should be made to raise plants in nurseries near culturable areas for this purpose. The planting should generally be effected along the ridges, where the rush of water is not so severe as to wash them away.

**Felling.**—The hills under consideration are so much denuded, that fellings of any sort are as yet unadvisable. On the contrary, it may be recommended that even the removal of rank vegetation should not be allowed, as such vegetation binds the soil and prepares necessary humus for the rapid growth of seedlings.

**Prohibitions.**—The demarcated area should, as far as practicable, be closed against grazing till the new growth can admit of it with impunity. The prohibitory acts, which may be enforced are given here :—

(*a*). Breaking up waste land for cultivation without permission.

(*b*). Setting fire to grass, trees, or brushwood, or lighting or carrying fire in such a manner as to endanger the safety of the demarcated areas.

(*c*). *Lopping, cutting, breaking or otherwise injuring* trees or bushes or bamboos.

(*d*). Collecting any forest produce, such as gum, resin, honey, wax, &c., without permission.

(*e*). Digging or quarrying stones, kankar or limestones without permission.

(*f*). Cutting or grubbing grass, removing dry wood without permission.

(*g*). Grazing cattle without permission.

**Gradual cultivation recommended.**—It may be noted that extensive cultural operations are not recommended at once, but should be introduced gradually when necessary funds are available. The areas may be demarcated, even when the cultural operations cannot be undertaken for some time to come, and the proposed prohibitions enforced. The areas thus protected will become naturally regenerated, and in a few years the appearance of these hills will be remarkably improved.

(*b*). *Proposals relative to the area extending to 300 yards on both sides of main roads to Abu.*

**Demarcation and Fencing.**—Demarcation and fencing of this area are out of the question. The forest growth of this area can be protected by the same process as the road side trees in the plains.

**Cultural operations.**—Cultural operations are not necessary beyond casual pruning, as self reproduction as well as regeneration will be sufficient.

**Prohibitions.**—The following prohibitions may be enforced :—

1. Walar cultivation.
2. Lopping, cutting, breaking, or otherwise injuring trees, bushes, and bamboos.

3. Browsing by camels, goats, &c.
4. Digging or quarrying stones, &c.

(*c*). *Proposals relative to an area selected to supply fuel and timber.*

**Selection of Area.**—This area should be as near the station as possible, so that its produce may be brought to the sanitarium with facility. If possible it should be free of rights, specially those of grazing, or else the rights should be compensated for or regulated within reasonable limits. The extent of this area, of course, should be according to the requirements of the station. If one compact area is not securable two or three pieces might be arranged for.

**Demarcation.**—This area may be demarcated as noted above.

**Fencing.**—*If necessary, the places where inroads of cattle* are apprehended, may be fenced by kucha masonry walls, which are, though costly, but indispensable to secure the good-will of the adjoining cattle owners.

**Natural reproduction to be encouraged.**—Sowing and planting should be undertaken when absolutely necessary, and when the funds for the purpose have been provided. It is recommended that natural reproduction should chiefly be encouraged by means of selection fellings. This simple system consists in felling mature trees at convenient places. Care should be taken that the trees growing along water-courses, roads and water-sheds, are not felled, nor those where they are few here and there in open places, or where they are required for the purpose of shedding seed. The trees growing densely should be thinned out without much exposing the soil. Those proposed for felling may be marked with lime to enable the coolies to find them out. Care is also necessary that the crowns of the remaining trees are, as far as possible, either in contact with each other, or adjacent, so that the hot rays of the sun do not dry up the soil, for the seeds have more chance of germination and growth in moist and friable soil than in one exposed, or where the surface soil gets not only parched by the heat, but is washed away by the rains. Further care is necessary that deformed, twisted, sickly, or stunted trees are principally removed, except where their presence is absolutely essential.

**Prohibitions.**—The prohibitions mentioned above under (*b*) may be conveniently introduced.

(*d*). *Proposals for the area of the hills outside the above selected places.*

**Demarcation and Fencing.**—The demarcation and fencing of

this area is entirely out of the question, because the population is scanty, and the distant hills of Abu principally under forest growth.

**Cultural operations.**—Cultural operations are not necessary, as the demand of forest produce, except at Abu station, does not exist.

**Fellings.**—Green and good trees should not be allowed to be felled for sale at Abu, except when they are specially required for timber. Dead, deformed, or densely growing trees of good girth, not standing along water-courses, roads, or water-sheds, may be sold and felled if required. Dry fallen wood may be conveyed to the station either free of charge, or on payment of some prescribed fees, as may be decided by the Raj. The privileges or rights of the people should of course be respected, but if any scheme can be devised to make them understand that the removal of trees from the banks of water-courses, sides of roads, or water-sheds, are injurious to forest conservancy, this would be highly commendable.

**Prohibitions.**—The only prohibitions required at present are, that "walar cultivation" be discouraged as far as possible in these hills. Browsing by goats, &c., requires regulation. These animals should only be allowed where their prohibition seriously affects the rights or privileges, and a suitable fee may be imposed on goats, &c., which are kept there for trade, so that this practice may be confined to the plains alone.

**Demarcated areas may be named "Forest Reserves."**—If advisable, the demarcated areas may be termed "Forest Reserves," and numbered consecutively, as well as distinguished by some local names.

**Permanent Nursery.**—For the purpose of raising delicate seedlings, as well as studying the growth of foreign species, it is necessary that a small permanent nursery, of about an acre or two in area, may be prepared in a convenient place where watering can be arranged without much expense. Perhaps a site near Delwara or Abu lake will be found suitable.

**Fire-protection.**—Among the chief enemies of forest conservancy, forest fires occupy a prominent place. They destroy in a short time what efficient protection and repeated cultural operations have produced in several years. Elaborate proposals for keeping out fire are uncalled for at present. However, the demarcated areas may be divided into blocks by fire lines, which should be kept clear of grass, &c., when it is dry. In other places of the hills conflagration should be discouraged as much as possible.

**Prohibitions.**—For the better protection of demarcated forests,

it is essential to frame and put into practice some prohibitions of acts likely to damage them. They are summarised in a previous page; but it is as well to explain the reasons here as follows :—

(*a*). This section is necessary to check walar cultivation, which is destructive of forests, as well as to prevent people from disposing of valuable forest produce under the pretence of clearing forest land for cultivation. Moreover, when there is ample room for cultivation outside the forest, it is quite superfluous to encroach upon the forest area set aside for well considered purposes.

(*b*). As grass and dry wood are not removed, the chance of fire breaking out becomes all the greater, hence urgent necessity for the prohibition.

(*c*). The simple reason for prohibiting the practice of lopping, &c., is that the standing growth is seriously injured thereby, and future regeneration rendered valueless.

(*d*). The prohibition against the indiscriminate collection of gum, &c., is evidently necessary, as it is generally observed that the persons gathering such articles do not, in the least, mind what great injury they invariably inflict upon the body of some of the valuable trees.

(*e*). With regard to quarrying of stones, &c., it may be observed that people, by their indiscriminate operations in some places, undermine the base of valuable trees, in other cases, cause landslips that result in obstructing the water-courses, damaging the roads and destroying surfaces previously covered with good vegetation. Hence it becomes necessary to prescribe particular spots for quarrying, after careful consideration of the various circumstances.

(*f*). The careless cutting of grass takes away with it many hopeful seedlings, while the survivors remain exposed to the inclemency of weather. Moreover, by this practice, materials of useful manure, are lost sometimes in places where their service is absolutely necessary for the rapid regeneration of denuded areas. The dry wood is similarly useful for enriching the soil.

(*g*). With respect to grazing, it may be pointed out that browsing animals, *viz.*, camels, goats, and sheep do great damage to the plants by eating off all their delicate parts and materially effecting their growth, while animals that simply graze are so far injurious, that they disturb the soil, and thereby damage the young growth. Hence browsing requires to be strictly prohibited, while grazing cannot be allowed without well considering the tracts in which it is likely to do the least injury.

**Procedure of preventing forest offences.**—With regard to the above prohibitions, as well as those that have been elsewhere mentioned, the procedure to be adopted for carrying them out may be conveniently left for the consideration of the local officials. But one point in connection with the subject is worth noting down, *viz.*, that, as far as possible, preventive measures are to be invariably preferred to direct punishments, &c.

**Establishment.**—The demarcated hills surrounding the sanitarium, and the area selected for the supply of forest produce to the station, require special establishment for carrying out various works and protecting the forest growth, while the protection of the area, extending to 300 yards on both sides of the main roads, can be conveniently left to the officials in charge of such roads. The forests in the hills outside the above noted places can be managed by the local revenue officials of the State, subject to the professional advice of the forest official in charge of demarcated areas. This official should be a qualified forester, otherwise efficient treatment of the forests cannot be expected. If available, one of the State officials, or a student of Serohi School, should be trained in the Forest School of Dehra Dún, or the services of a trained man may be secured. The strength of forest establishment will, of course, depend upon the areas selected and efficiency of protection required.

**Revenue and Expenditure.**—To defray the necessary expenses of reboisement, as well as maintenance of forest establishment, it is necessary that adequate funds should be provided. In Murree a sanitarium of the Punjab, such funds are set aside out of the income derived from forest produce consumed at the place. Permits are issued by the Municipality or Forest Department for dry wood and grass removed from lands under their respective jurisdictions. Available standing trees are either sold by public auction, or on application of traders at prescribed rates. Annual contracts are given for the supply of forest produce to the Government troops. A depôt for the supply of charcoal to the residents at fixed rates is maintained by Forest Department. As a rule, the site, method, and time for cutting or removing forest produce are prescribed in the permits, &c. If similar procedure be gradually introduced at Abu, the necessary provision will, in time, be obtained, but to initiate the conservancy arrangements, it is necessary that the State may provide some money before the Department can be self-supporting.

JEYPORE,<br>*5th October*, 1886.

SADHU SINGH.

# BEETLE DESTRUCTIVE TO SAL COPPICE SHOOTS.

I HAVE noted, as stated in some of my reports to Government, that the succulent shoots of coppice sál saplings were ringed by some insects, in the rains, because the marks left in October—November, showed that they were comparatively recent, and the dead upper portions showed that the leaves had reached maturity; it was probable also that the ringing was done by flying insects, as the tops of the shoots (within a foot or two of the top) were the parts usually affected.

As the ringing of the bark, and the consequent destruction of the portions of the stem above it, render the coppice shoots liable to be crooked or to bifurcate, I desired, if possible, that the insect might be discovered. The insect which, from Mr. Thompson's report, I believe to be a species of *Monochamus*, of the family *Longicornes* (Capricorn beetles), order *Coleoptera* (beetles) of Baron Cuvier.* The insect was found at work in the evening (so reports the Forester), and a specimen of the ringing was also sent. It is probable that the insects use the soft bark for their own food, but the quantity used seems to me so large compared to the size of the insect, the bark removed from one stem being of greater weight than the insect itself, and nearly every coppiced stem is thus ringed, that it seems to me just possible, that this species of monochamus prepares a larger ball of masticated succulent bark to deposit its eggs in, as is done somewhat similarly in the case of the common dung beetle, as it is hardly probable that this beetle commenced its attacks in the pupa state in the unhealthy tree, and finishes them when in the complete state by damaging the health of the tree. The horns are not long enough for *Cerambyx vatica* (Plate VIII., figures 13 and 14, larvæ 15 and 16) or sál beetle of the same family, the larvæ of which are found in dead or decaying sál.

E. WOOD, *Captain*,
*Conservator of Forests, Oudh.*

---

IN anticipation of the specimens being precisely determined, we may notice that the insect sent by Captain Wood, and described above, has the same habits as the American "Hickory twig girder" (*Oncideres cingulatus*), which also belongs to the cerambycidæ.

In the case of the Hickory twig girder, the mother beetle deposits her eggs in notches, which she cuts in the bark of hickory

* Plate VIII., figures 1 and 2, but rather longer I think.

branches, and then proceeds to gnaw a groove around the branch just below where the eggs are deposited ; so that the terminal portion of the branch dies, and the larvæ, on emerging from the eggs, feed on the dead wood.

It is well known that all cerambycid beetles prefer to lay their eggs in trees which are in an unhealthy condition, and also that trees killed by the artificial girding of their stems are peculiarly subject to attack: the most probable explanation being that the copious flow of sap in a healthy tree is prejudicial to the life of the boring grub. We see, therefore, that the girder beetle only reproduces on a small scale the conditions which, when they occur accidentally, are peculiarly well suited to the development of its larvæ.

As the eggs are deposited beyond the groove, the most effectual preventive measure is obviously to collect and burn all the withered portions, so as to destroy the grubs. In the case of the American species, it has been found that the groove generally weakens the branch to such an extent as to cause it to break off and fall to the ground with the first wind, hence the systematic burning of all wind-fallen branches is sufficient to check the evil. It would seem worth while therefore to ascertain whether the groove made by the Indian species has the same effect, and on this to a certain extent would depend the practicability of preventing similar damage in future years.

DEHRA DUN, E. C. COTES.

*13th October*, 1888.

---

## INACCURATE ACCOUNT OF INDIAN WOODS.

I HAVE just come across an extract from the 'Indian Engineer' republished by the 'Madras Mail,' and cannot help writing to draw your attention to it. *Surely the time has now come, with* the publication of Floras and Manuals and Dictionaries of Indian Economic Products, for something better than this, which reads like a return to the days of Balfour's 'Timber Trees' and similar publications which, though they undoubtedly were in their day, of the greatest value and help, are now considerably behind the age. Surely better than this might have been expected from a writer so well-known for his most useful Timber Tables, and so eminent an Engineer, as the late Mr. Kunhya Lall, Rai Bahadur, and one cannot help thinking that the paper published under his name must have been written years ago, but never published, and that he himself would not have approved of its publication. A

few glances at Brandis' 'Forest Flora' would have saved the paper from many *inaccuracies*. What can be more absurd than to speak of "the bamboo (*Bambusa arundinacea*)" as if there were but *one* bamboo in India, and as if, if the chief one were intended, the universally found *Dendrocalamus strictus* would not have been chosen in preference as a type. Again, *Diospyros Ebenaster* (an old species of Roxburgh's now merged in *D. Ebenum*) is not *the* Indian ebony, so much as the more common *D. Melanoxylon*. *D. Ebenum* only occurs in the south of the Madras Presidency, and even there is by no means common, and by no means in *general* use for cart axles. Again, the 'shisham' of the Punjab, which is used for furniture in that Province, is not *Dalbergia latifolia* (which is the blackwood), but *D. Sissoo*, and so on, as any Forest officer will at once see, but the extract reads more like a school boy's essay than a description intended to be useful to Engineers. And the woods mentioned are not all really timber woods, for who among us has heard of the use of ebony or tamarind in engineering? Trusting you will excuse my drawing your attention to this slipshod way of treating an important subject.

M. K. M. B.

---

## THE STATUS OF FOREST RANGERS.

With reference to the notification of the Government of N.-W. Provinces and Oudh of 19th March, 1887, directing that Forest Rangers hold the same status as the Inspectors of Police do, the question arises whether Forest Rangers are allowed seats in the Durbar, when it takes place within their jurisdiction, in the same way as Inspectors of Police, it is presumed, are allowed.

Do the District Forest Officers in Berar get seats in the local Durbar when it takes place in their jurisdiction? Information on these points, through the "Indian Forester," will much oblige.

S. S.

In reply to the above enquiry, it is noted that the Government of the N.-W. Provinces has ruled that Forest Rangers, 1st grade, rank *next to* Inspectors of Police, 1st grade, and above Inspectors, 2nd grade, and that Forest Rangers, 2nd grade, rank above Inspectors, 3rd grade, and so on.

All Forest Rangers are clearly entitled to a seat in Durbar.

The following copy of Circular, No. 19F., dated Simla, the 26th July, 1888, of the Government of India, Revenue and Agricultural Department (Forests), gives the opinions of the Government of India on this subject :—

After consideration of the replies to the Circular of 7th May, 1887, the Government of India is of opinion that it will be desirable to leave it to Local Governments and Administrations to pass such orders as they may deem expedient in regard to the question of local precedence between Forest Rangers and other classes of public officials. At the same time, the Government of India is disposed to concur in the view of the matter taken by the Government of the Punjab, *viz.*, that Rangers should be conceded the privilege of a chair when visiting European officers, and that, if of a certain standing, they should be entitled to admission to Provincial Durbars held in the District or Revenue Division in which they are employed.

It is clear, therefore, that the Government of Berar can pass such orders regulating the position of Rangers as it considers advisable, and that Government would doubtless not wish its Rangers to have a lower status than those of other provinces.—[ED.]

## DENDROMETERS.

IN the July number of the "Forester" a question is raised with regard to the accuracy of Weisse's dendrometer, and the advantages of Faustmann's instrument are stated.

I formerly used a Faustmann and now use a Weisse, which I prefer to the former for the following reasons:—

1*st*. It is made of brass and white metal, and is not therefore so liable to injury from heat and moisture. It could be used in the rains in Burma, when an instrument of wood and paper could not be used.

2*nd*. The plummet is heavier than that of Faustmann's instrument, which is of great advantage, especially when a strong wind is blowing.

3*rd*. There are nineteen teeth to the inch, and the instrument is therefore on a larger scale than that of Faustmann.

Both instruments are the same in principle, and there should be no difference as regards accuracy, if both are tested under most favourable conditions; but under unfavourable conditions (high wind), I am of opinion that Weisse's dendrometer would give better results.

Weisse's instrument is less portable, measuring in its case 9″ × 2¼″ × 1½″, and is more expensive.

In my instrument the alternate teeth are marked 1, 2, 3, 4, &c. For measurement in feet, it would be more convenient if the alternate teeth were marked 2, 4, 6, 8, &c., and if any Forest officer should order a dendrometer, I would advise him to have it marked in this way.

P. J. C.

## FORESTRY IN A NATIVE STATE.

It is heard from a trustworthy source that His Highness the Rajah of Nabha in the Punjab, has appointed three men on Rs. 20 each a month, and has posted them to each of his three *nizamats*. These men are placed in charge of nurseries, which are started at convenient places. Their work is supervised by one Superintendent, posted at head-quarters of the State. The pay of the Superintendent is Rs. 60 a month. It is contemplated by His Highness that all the village boundaries of his 600 villages should be planted with trees, so that the boundary disputes should not arise by the *zemindars*.

If this policy of utilizing the service of trees on boundary lines be considered and discussed in the pages of the "Indian Forester," I think forestry can add one more advantage to itself. If the move of His Highness is in the right direction, surely this subject can be brought to the notice of District authorities, and some means of introducing this system in British India may be devised.

S. S.

---

Owing chiefly to the enterprise of several traders, the fiftieth year of Queen Victoria's reign is likely to be well impressed on our memories, the word Jubilee having been attached to goods of the most opposite descriptions. Mr. Asshton Smith is determined that the event shall be recorded in a very prominent way. He has caused to be planted on the side of a mountain in Wales, Moel Rhimen by name, a plantation of nearly seven thousand trees, which will be so arranged as to represent the words 'Jubilee, 1887.' The letters each measure two hundred yards long, by twenty-five feet wide; and two hundred men, it is said, have found constant employment in planting the trees since Jubilee day, when the work was commenced.—*Chambers' Journal.*

## IV. Notes, Queries and Extracts.

Forest Conservancy in Ceylon.*—The necessity for the conservation of the forests of Ceylon was first brought into prominent notice in 1873 by Doctor (now Sir Joseph) Hooker, who, on the report of Doctor Thwaites, then Director of the Botanic Gardens, Peradeniya, addressed the Secretary of State for the Colonies on the subject of the destruction of the forests in Ceylon, and the evil effects resulting therefrom upon climate and upon the natural resources of the Colony in future generations.

The Government of Ceylon had been alive to these evils, and to a certain extent had endeavoured to provide against them, but as forest conservation on a sufficient scale demands a considerable expenditure at the outset until the revenue derived renders a Forest Department self-supporting, it did not feel itself in a position to grant the necessary supplies for the purpose. Notwithstanding this, efforts were made by the Government in other directions to mitigate the evils attending indiscriminate sales of land. In 1882, Mr. Vincent, of the Indian Forest Service, was, on the application of the Ceylon Government, deputed by the Government of India to report on the forests of Ceylon. His valuable report was published as a Sessional Paper, No. 43 of 1882.

As the result of this report, and of a desire on the part of the Government to carry out forest conservation on a satisfactory basis, an Ordinance was passed in the session of 1885, intitled "The Forest Ordinance." The object of this Ordinance and of the rules made under it is, in the first place, to select suitable areas of forest lands and to constitute them State reserved forests ; to buy off or to commute by the grant of land any rights which the population in the vicinity may have acquired in these lands ; to mark off on the ground the boundaries in an unmistakeable manner : to place these areas under effective protection ; to improve them by sowing and planting wherever necessary ; and, generally, to introduce system where there had been no system. As the result of systematic treatment, it is hoped to guarantee a permanent sustained yield of timber, fuel, and minor forest produce, not only for the existing, but for future generations, to improve the climatic conditions, and

* Report of the Conservator of Forests for 1887.

by judicious restrictions in regard to harmful cultivation to meet the wants, and safeguard the interests of all classes of the community. There can be little doubt of the success of these measures, provided they are carried out with intelligence, fairness, and firmness on the part of the Government officers, together with an appreciation on the part of the people of the general benefit to the community that the Government has in view.

Although the object of the State in the execution of the important trust committed to it, both in regard to the welfare of the present and future generations, is strictly conservative, and has higher aims than the mere acquisition of revenue; still, judging from the results of forest conservation in India, the revenue to be derived from proper management is far in excess of the cost of establishments and working. Ceylon has in its forests timber and minor produce of not less value, comparatively, than those of India, where the receipts in the year 1883-4 amounted to £1,052,190, and the clear profit to £403,815. Up to a very recent period this valuable State property in Ceylon, more particularly the forest produce, has not been disposed of to the best advantage. The Crown forests have been systematically plundered by a gang of native timber thieves, who, often with the connivance of native headmen, gained a rich harvest, thereby depriving the people generally of a revenue which should have passed into the Colonial Exchequer, and should have thereby benefitted the community at large. An organised Forest Department will in the future aid the Government Agents in securing to the country this important branch of the revenue.

Not only are our forests worth preserving for the valuable timber, fuel, and minor produce they contain, and for the employment that forest management provides for a certain proportion of the population; but by judicious conservation, their indirect value as affecting the climatic conditions, and therefore the wants and interests of the people generally, will be greatly enhanced. There can be little doubt that forests render climate more equable, increase the relative humidity of the air, and possibly augment the rainfall. In tropical countries like Ceylon, where the rain falls at certain seasons only, and then falls in heavy showers, a covering of forest protects the soil from being washed away, and thereby mitigates the silting up of rivers and low lands. In this respect Ceylon has in the past suffered much by denudation. Again, forests regulate the water-supply, insure the sustained yield of springs, and render the flow of water in rivers more continuous; they reduce the velocity of the wind, and afford protection to the neighbouring fields.

Further, forests afford shelter to cattle and useful birds, and under suitable treatment improve the healthiness and picturesqueness of the country.

Many instances might be cited of the evil effects of forest denudation in almost every country of the world ; but some very striking ones were given in evidence in 1885 before the Select Committee of the House of Commons on Forestry, affording a useful warning of what might happen at no distant date in Ceylon, unless preventive measures are taken. It was given in evidence by the late Political Agent of Jinjira, in Western India, that that Native State, about 40 miles long and from 15 to 100 miles wide, was at one time entirely covered with forest, but owing to the demands of the city of Bombay, three-fourths of the forest, in consequence of indiscriminate felling, disappeared within seven years, and the remaining fourth was only saved with difficulty. The result to this Native State was simply ruinous, and if unchecked, would have deprived it of all its resources. Another instance was brought before the notice of the Committee. The district of Ratnagiri, 50 years ago, used to be the great rice-producing district of the west of India, when there were dense forests extending up to the Western Ghâts. In the present day, the country up to the crests of the hills has been laid bare of forest growth, and the people complain bitterly of the bad yield of the rice land below, which has been attributed to the destruction of the forest operating to prevent the water from being stored upon the hill-sides : it runs away in violent floods instead of flowing gently over the country. There are parts of Ceylon at this moment, in the Southern and North-Western Provinces and in the Province of Uva, where the havoc of the chena cultivator threatens to repeat the disasters of Ratnagiri.

In the middle of 1887, Mr. A. Thompson, of the Indian Forest Department, was deputed from India to advise the Government of Ceylon on the conservation of its forest. That officer, however, speedily lost his health, and in September of the same year resigned his appointment. Before leaving the Island he expressed the opinion that the most pressing matters to be undertaken were the selection, demarcation, survey, and settlement of reserved forests. Mr. Thompson, owing, it is presumed, to want ot time, left behind him no scheme of operations for the coming year. On his departure in October the Surveyor-General was appointed Acting Conservator of Forests in addition to his own duties. One of the most important matters that the Acting Conservator had to submit for the instruction of Government was the position of Foresters

in relation to the Government Agents and the newly-created appointment of Conservator of Forests. There is much to be said from a technical and departmental point of view in favour of Foresters being entirely under the control of the Conservator of Forests; and, on the other hand, there is a good deal that may be adduced from a political point of view in favour of placing the Foresters under the Government Agent. From a technical point of view it is of the first necessity that the working of the forests and the cultural operations connected therewith in order to ensure the proper continuity of the work, should be considered solely the business of the Conservator of Forests, subject of course to the supervision of Government. This reason alone might by many be considered sufficient cause for the Forest officers to be placed beyond possibility of interference by Government Agents. On the other hand, from a political point of view, it might be very properly urged that a Forest Department, working entirely without the knowledge of the Government Agent, might be neglectful of the interest and requirements of the people, and be prone to press the provisions of the Forest Law too hardly against them.

With these chief considerations in view, I submitted to Government that a middle course was advisable, and that the Forester of a province should carry out the various forest works of demarcation, conservation, cultural treatment, &c. (as agreed upon annually by the Government Agent and the Conservator of Forests, and approved by Government) under the authority and protection of the Government Agent, while in administrative matters connected with discipline, pay, promotion, transfer, &c., he should be directly under the Conservator of Forests. By this dual subordination, provided the Government Agent and Conservator of Forests worked harmoniously together, and co-operated towards the common end both have in view, I conceived that the interests of both forest conservation and of the people would be met, in that the just demand, and requirements of forest conservancy will be attended to under the full authority of the head of the province, while full control over the Departmental finance and over the organisation and technical part of the work, is reserved to the Conservator of Forests, Government was pleased to approve of this recommendation.

The matter next in importance was to draw up a project of operations for 1888. The Acting Conservator of Forests placed himself in communication with the Government Agents, and after learning their views drew up the following plan of operations for the year 1888 under the respective headings of—(*a*), Forest Demarcation; (*b*), Timber and Firewood Supply; (*c*), Re-afforestation;

(*d*), Extra Establishment. The plan of operations was sanctioned by Government in March 1888.

(*a*). *Demarcation.*—This subject is considered to be of primary importance, because, until the forests are selected for reservation, and the rights of the neighbouring population judicially inquired into and settled, and the forest boundaries properly defined and marked out on the ground, the law for their protection against encroachment and illicit felling cannot be satisfactorily enforced. It was therefore recommended to Government that the surveys required as preliminary to the examination of claims, and for the demarcation of boundaries on the ground should be actively proceeded with so far as the resources of the Survey Department would allow. It was further represented that the first measures of forest conservation should be directed to the neighbourhood of the large cities and towns, where, owing to the requirements of a dense population, the forest is rapidly disappearing for want of effective protection. At the same time, the firewood supply for the railway, both as it exists at the present and its probable requirements in the future must not be lost sight of. It was submitted to Government that, speaking generally, there is no immediate necessity to demarcate the forests in the vast tracts which cover the whole face of the Northern, Eastern, and North-Central Provinces, as these are less open to encroachment, but that all available strength should be concentrated for the present on the remaining provinces. In the event of this suggestion meeting with the approval of Government it was proposed, in the Western Province, to demarcate the Mitirigala and Kananpella forests, both of them important from their situation near to Colombo on the banks of the Kelani. The survey of the Kelani reserve, which was commenced in 1887, will, it is hoped, be completed in 1888. Nearly the whole of that part of the so-called reserve which lies in the Central Province is found to be almost non-existent; while that part which lies in the Western Province will only be of value as a climate reserve. The rest has disappeared before the squatter and chena cultivator.

With regard to the large surveys carried out under the Adam's Peak range in the villages of Gilimale and Bambarabotuwa, the plans of which are now ready, it will be for Government to determine what parts of the forest should be reserved for climatic and timber purposes, and what should be sold. When this is done, the reserved forest should at once be demarcated, and the rights of the native determined and judicially settled.

In the North-Western Province it is proposed to demarcate important reserves just outside the towns of Puttalam, Kurunegala,

and Chilaw, as a first step. There are other important forests in this Province which must be demarcated at an early date, before they become a prey to the chena cultivator.

In the Central Province there is work to be done in the selection and demarcation of forests in the Matale District, while in the Nuwara Eliya District the importance of maintaining the boundaries of Crown forests against encroachment becomes more and more marked.

In the Northern Province it is desirable to select and demarcate several thousand acres as a reserved forest within accessible distance of the town of Jaffna.

(b). *Timber and Firewood Supply.*—By consensus of opinion among the Government Agents, the present system of allowing timber to be cut in Crown forests by contractors for the use of the Public Works Department or by private individuals on permit is universally condemned, as little or no check can be exercised, and the revenue fails to get the value of the timber carried away. It is proposed to introduce an entire change in the system, or want of system, and in lieu of it to establish depôts at the chief centres where there is a sufficient local demand for timber and firewood to warrant the expense of their establishment. The trees in demand for timber will then be felled as they arrive at maturity, allowed to season, and be transported to the depôt to be sawn to the best advantage. In cutting out these trees there will be much branch wood which has hitherto been left to decay in the forest, but which will now be brought to depôt for sale as firewood. By thus utilising every part of the tree, whether cut down for timber, or in thinning out, or in opening out the necessary cart tracks, there is little doubt that considerable revenue will be derived. Moreover, the firewood supply being undertaken by the Forest Department, traders and their coolies will be kept out of the Crown forests, which they have been accustomed to rob with impunity. It may be well here to mention that there seems a tendency in some places to fell timber before it arrives at maturity. In this green state timber lacks strength and durability, is more susceptible to dampness and to the attack of white ants, and is especially liable to split while seasoning. Where firewood is sold by weight there is an especial tendency to fell in the green state, for then the firewood is much heavier than when mature. There is a certain age at which a tree reaches its maximum weight: after that it loses in weight but gains in strength and durability until the age of maturity is reached.

Further, it is proposed, that instead of, as heretofore, the Gov-

ernment Agents felling separately, each for his own Province and without reference to the others, the annual felling should be regulated by the Conservator of Forests in communication with Government Agents according to the demands for Government use, the local demands of the public, and for export. In this way the balance between demand and supply will be better maintained.

It is proposed to have two main depôts, one at Colombo and one on the east coast. To the former depôt would be consigned all ebony, the best satinwood, and the better classes of cabinet woods, such as find favour for use in the capital or for export to Bombay, China, or England; while at the latter depôt would be sold such woods of the better classes as are in demand at Madras, but whose prices would not bear the cost of freight to Colombo. All inferior logs of cabinet woods and other timber of inferior sorts should be sold locally.

The principal of this arrangement may be summarised, that all superior classes of timber should be sold at Colombo when competition is rifest, while the inferior classes that would not pay the cost of transport should be disposed of locally.

During the year 1888 it is proposed to establish depôts at the following places:—

| | |
|---|---|
| Western Province, ... | Colombo.<br>Kalutara (later on). |
| North-Western Province, | Kurunegala.<br>Puttalam. |
| Northern Province, ... | Jaffna. |
| North-Central Province, | Trincomalee (Eastern Province). |
| Eastern Province, ... | Batticaloa. |
| Southern Province, ... | Galle. |
| Central Province, ... | Nuwara Eliya, Nanuoya, Kandy, Matale. |
| Province of Uva, ... | Badulla, Haputale. |

The question of supplying sleepers to the railway will have serious attention. The woods of Ceylon have not had a fair trial up to the present time, and it is very important that we should, if possible, meet the demand for sleepers from our local resources. Palai (*Mimusops indica*) and Kumbuk (*Terminalia glabra*), which are most abundant in this Island, would, it is believed, be excellent woods for sleepers, and there are several others deserving of trial.

(c). *Re-Afforestation and Conservation.*—It is the opinion of experts that questions of re-afforestation may speaking generally, wait in this country until the more necessary measures of demar-

cation have made progress. In regard to re-afforestation there seems to be some misapprehension. It appears to be supposed that any kind of tree, whether indigenous or exotic, only requires to be put into the ground in order to grow. No greater mistake could be made, and disappointment and waste of money can only result from any such treatment. Some seedlings require sun, others shade ; while soil, aspect, climate and altitude have all to be taken into account in determining what species will thrive in a given place. Projects of re-afforestation must be very carefully considered, and nothing done with precipitation. One great defect hitherto is, that some of the plantations in this country are neglected after they are once started, and for want of the requisite thinnings the young trees have grown up weakly, and are of little value in consequence. This is, of course, due to the want of the necessary establishment to look after the trees until they have become well started ; but it is none the less an unfortunate circumstance. As a rule, it is desirable to take up large areas rather than small for re-afforestation—say, not less than 500 acres—to fence it in properly in proportion as it is planted, and not to spare labour until the young trees are well established. Small areas incapable of extension are costly in supervision. Indigenous timbers should be cultivated in preference to exotic, except in special localities. The mainstay of our work for some years should be the planting of the species which are known to thrive and produce good serviceable timber in the localities where they are to be planted. Many of our forests have been overworked, and require rest ; for instance, in parts of the Eastern Province, it will be the duty of the Forester to make a careful survey of such forests, so as to determine the period of rest, to examine what prospects there are of seedlings of the better species growing up, or, if not, what areas should be replanted, and with what species. I do not quite share the view held by Mr. Vincent that reproduction is generally bad in this country. On the contrary, I have been much surprised at the way in which satin and halmilla, two of our most important trees reproduce themselves vigorously in unexpected places, such as on the borders of chena lands or in places where the leaf canopy has been destroyed, and light accidentally let into the forest : given, of course, that the conditions in other respects are favourable to the growth of these species. In some of the ebony forests, too, the reproduction is satisfactory. All that is required is the establishment necessary to assist the saplings, and by fellings to preserve them from being choked by inferior species. With respect to the conservation and working

of the forests, we shall, until the surveys and demarcation are complete, have to limit our cultural operations of the system known as that of *natural regeneration*, whereby the trees are only gradually removed as they arrive at maturity, so as to effect the regeneration of the forest by seed in the natural way, and to afford protection for a time to the young growth. With this cultural treatment we must combine the mode of working by compartments, whereby all the different compartments included in a forest are worked annually in rotation and given complete rest during the remainder of the period, so as to admit of their being properly protected during the years of reproduction. By this arrangement timber-cutters and coolies will be prevented from indiscriminate felling over the whole forest, which has done so much harm in the past.

(*d*). *Extra Establishments.*—As it is most important to check the illicit felling, which goes on unimpeded more or less over the whole Island, it is proposed to augment the present establishment by adding to it river watchers, forest rangers, and forest guards, in order to help in the detection of these malpractices, and to bring them to official notice.

COLOMBO,<br>*April 14th, 1888.*

F. C. H. CLARKE,<br>*Actg. Conservator of Forests.*

---

THE timber trade in Siam is rapidly increasing, and several large rafts of teak, which are said to exceed in size the one that lately broke loose off the coast of Canada, are shortly expected in the Bangkok river. Their arrival will probably block the river for some three or four miles.—*Timber Trades Journal.*

THE

# INDIAN FORESTER.

**Vol. XIV.]** **December, 1888.** **[No. 12.**

## FORESTRY IN HUNGARY.*

By Lt.-Colonel F. BAILEY, R.E.

NOTE.—The greater part of the information regarding the Hungarian forests, *given in Chapter I., was derived from the volumes of statistics* prepared by the Hungarian Forest Department for the International Exhibition at Buda-Pesth in 1885. That given in the "General Description" of the Bánát was obtained from the work prepared by the State Railway Company for the International Exhibition at Paris in 1878.

### CHAPTER I.

#### THE HUNGARIAN FORESTS.

AREA, ELEVATION, CLIMATE, SPECIES, AND DISTRIBUTION OF TREES.

The total area of the kingdom of Hungary, including Croatia and Slavonia, is 125,370 square miles, of which 35,459 square miles, or over 28 per cent., are forests, owned by the following classes of proprietors :—

| | Square Miles. | | |
|---|---|---|---|
| The State, ... ... ... ... | 5,553 | or 16 | per cent. |
| " studs, railways, War Department, | 170 | | |
| Departments and Communes, ... ... | 8,200 | or 23 | " |
| Corporations and Ecclesiastical endowments, | 2,071 | or 6 | " |
| *Public foundations,* ... ... ... | 319 | *or 1* | " |
| Private " ... ... ... | 8 | | |
| Trustees, ... ... ... ... | 1,999 | or 6 | " |
| *Joint proprietors,* ... ... ... | 5,101 | or 14 | " |
| Joint Stock Companies, ... ... | 654 | or 2 | " |
| (A.) | 24,075 | or 68 | " |
| Private persons (B.) | 11,384 | or 32 | " |
| Total, ... | 35,459 | or 100 | " |

This gives nearly $1\frac{1}{2}$ acres of forest per head of the population.

* Reprinted from Transactions of the Royal Scottish Arboricultural Society, Vol. XII., Part i., 1887.

Forests in Class (A.) must, under section 17 of the Forest Law, be managed in accordance with the provisions of a working plan, approved by the Minister of Agriculture, and framed on the principle that they are required to give a constant annual yield for ever. Consequently no portion of them can be disforested. But the private forests, about one-half of which are owned by a small number of proprietors, some of whose immense domains cover many square miles, are, unless they have been declared "Forests of Protection" under the law, worked according to the wish of the owner; who, however, may not disforest any portion of them which grows on a purely forest soil—that is to say, a soil which is incapable of being profitably cultivated, either as fields, gardens, or vineyards, or of being used as meadow land.

Section 2 of the law includes, under the head of Forests of Protection, all forests situated in high mountain regions, on loose stony soil, alpine plateaux, peaks, ridges, or steep slopes; also those which serve either as a shelter against dangerous storms, or as a protection against landslips, inundations, and avalanches, and the removal of which would consequently involve injury to lands and lines of communication situated below them. The law provides that, within five years of its promulgation, a list of all such forests must be prepared; that they must all be demarcated; and that, no matter to whom they belong, they must be worked in accordance with the provisions either of a working plan, or of rules approved by the Minister of Agriculture.

The area of the State forests was much larger in former years than it is now—a loss of 20 per cent. having been experienced since 1878. This is mainly due to the commutation of rights, many of which have been got rid of by the surrender of land given in exchange for them; but there is still a good deal to do in this direction, though not nearly so much as has already been accomplished between 1880 and 1884. The diminution from this cause of the area of the State forests amounted to 1,427 square miles. The following areas are administered by the Forest Department, in addition to the State forests (5,553 square miles) shown above, *viz.:*

| | | Square Miles. |
|---|---|---|
| In towns, ... ... ... | ... | 4 |
| Unavoidably retained as being enclosed within forest boundaries, ... ... ... | Arable fields, ... | 48 |
| | Meadows, ... | 63 |
| | Pastures, ... | 120 |
| Alpine pastures, ... ... ... | ... | 325 |
| Unproductive land, ... ... | ... | 153 |
| | Total, ... | 713 |

So that the total area in charge of the Department amounts to 6,266 square miles.

The forests of Hungary are situated in the following zones of altitude :—

| Square Miles. | | |
|---|---|---|
| 5,206, or 15 | per cent. | below 200 metres (656 feet). |
| 9,935, or 28 | „ | between 200 and 600 metres (656 and 1,968 feet). |
| 20,318, or 57 | „ | above 600 metres (1,968 feet). |
| 35,459 | | |

Forty-two meteorological stations have recently been established in or near the forests, for the purpose of observing the temperature and degree of moisture of the air, the direction and force of the wind, and the amount of rainfall. The data furnished by these stations are collected and tabulated in the central office at Buda-Pesth. Observations recorded at altitudes varying from 16 feet (Fiume) to 2,526 feet (Fajna in Mármaros) show that, in 1884, the maximum rainfall amounted to 63 inches (Fiume and Goszpics, both in the south); while the minimum, 4 inches, occurred at Petrozsény in the east. The maximum temperature rose to 100° Fahr. at Szolnok in Lower Hungary; and the minimum, 23° below zero Fahr., was registered at Szepes-Iglo in the north, at an altitude of 1,525 feet. The highest mean temperature, 59° Fahr., was at Zeng, and the lowest, 40° Fahr., at Fajna in Mármaros.

The forests are thus classed, according to the quality of the soil on which they grow—

| | Square Miles. |
|---|---|
| Purely forest soil, as above defined, .. .. | 28,505 |
| Soil adapted for other uses, .. .. .. | 4,785 |
| Plantations on moving sands, .. .. .. | 420 |
| Forests of Protection, .. .. .. .. | 1,749 |
| Total, .. | 35,459 |

It is said that the various species of trees are found in the following proportion, *viz.* :—

| | Per cent. |
|---|---|
| Oak (*Quercus pedunculata* and *Q. sessiliflora*), .. | 22·28 |
| Oak (*Q. cerris*), .. .. .. .. | 5·72 |
| Beech (*Fagus sylvatica*), .. .. .. | 36·54 |
| Hornbeam (*Carpinus Betulus* and *C. orientalis*), .. | 9·13 |
| Birch (*Betula alba*), .. .. .. .. | 2·39 |
| Carried forward, .. | 76·06 |

| | Per cent. |
|---|---|
| Brought forward, | 76·06 |
| Poplar (*Populus alba, P. canadensis, P. nigra, P. pyramidalis, P. tremula*), .. .. .. .. | 2·38 |
| Willow (*Salix alba, S. Caprea, S. fragilis, S. purpurea, S. triandra, S. viminalis*), .. .. .. | |
| Ash (*Fraxinus excelsior* and *F. Ornus*), .. .. | 1·52 |
| Elm (*Ulmus campestris, U. montana, U. suberosa*), .. | |
| Maple (*Acer campestris, A. platanoides, A. Pseudo-platanus*), | |
| Alder (*Alnus alpina, A. glutinosa, A. incana*), .. .. | 0·47 |
| Acacia (*Robinia Pseudo-acacia*), .. .. .. | 0·39 |
| Lime (*Tilia argentea, T. grandifolia, T. parvifolia*), .. | 0·09 |
| Spruce (*Abies excelsa*), .. .. .. .. | 13·81 |
| Silver fir (*Picea pectinata*), .. .. .. | 3·31 |
| Scots pine (*Pinus sylvestris*), .. .. .. | 1·91 |
| Larch (*Larix europœa*), .. .. .. .. | 0·06 |
| Total, .. | 100 |

The following trees and shrubs also occur in the forests, but not in sufficiently large numbers to be mentioned separately in the above list :—*Quercus pubescens, Q. hungarica* v. *conferta, Castanea vesca, Corylus Colurna, C. avellana, Sorbus Aria, Prunus spinosa, Juglans nigra, Platanus orientalis, Morus nigra, Rhus Cotinus, Cornus sanguinea, Pinus austriaca, P. Mughus, P. Cembra, Juniperus communis, Taxus baccata.* Experiments with a view to the introduction of certain foreign species have been made in the State forests.

The areas actually covered by the principal groups of species are as follows, *viz.* :—

| | Sqare Miles. |
|---|---|
| Oak, .. .. .. .. .. | 9,930 |
| Beech and other broad-leaved species, .. .. | 18,761 |
| Conifers, .. .. .. .. .. | 6,768 |
| Total, .. | 35,459 |

The following table shows the area occupied by each of the principal groups of species in the State forests, and their distribution throughout the three zones of altitude :—

| Metres. Feet. | Oak. | Beech and other broad-leaved Species. | Conifers. | Total. | No. of permanent Springs. |
|---|---|---|---|---|---|
| Plains, 0 to 200= 0 to 656, | 515 | 310 | 1 | 826 | 100 |
| Low hills, 200 to 600=656 to 1968, | 380 | 906 | 92 | 1,378 | 1,002 |
| Mountains above 600=above 1968, | 51 | 1,734 | 1,564 | 3,349 | 11,861 |
| Total square miles, | 946 | 2,950 | 1,657 | 5,553 | 12,963 |

## Management and Working.

Previously to 1848, when the feudal system still prevailed in the country, the Hungarian forests were, generally speaking, valued almost solely on account of the game which they harboured. They were very little worked, and their revenue was merely that obtained from grazing, from the collection of acorns, and from the sale of firewood ; timber was used exclusively for local purposes. A few forests only, situated either near rivers, such as the Danube, Tisza, Garam, Vag, and Arva, or around mines and smelting furnaces, or in the neighbourhood of large towns, yielded any considerable income to their owners. After the year 1850, when the feudal system had ceased to exist, the situation was extremely unfavourable to proprietors of land, who, a few years later, when, in consequence of the extension of railways, new markets were opened, tried, without thought of the future, to realise as much as they could from their forests, the importance of maintaining which they failed to understand. They did not, in most cases, possess the capital required to work them on their own account, and they therefore farmed them out, on from five to ten years' leases, to merchants and contractors, whose sole aim was to get the timber out at a cheap rate. The proprietors were unacquainted with the prices paid for wood in the market ; they would not incur the expense of having their forests properly valued, and were ignorantly satisfied if they received considerable sums of money for forests of large extent, even though the rates paid to them were ruinously low. The first merchant who come carried off the finest timber, those who followed him taking, each in succession, his choice among the best of the trees which remained, and paying still smaller prices.

In this manner the wood was cleared out of the more accessible forests by slides, canals, and streams, and they rapidly became denuded ; while the large quantity of waste-wood, resulting from a too prodigal felling for large timber, brought about a depreciation in the price obtainable for firewood in other forests. In consequence of this, and of the general absence of communications in the country, which caused the timber over the greater part of it to have little or no value, a large proportion of the best oak forests were ruined by continued grazing, and were reduced to the condition of forest pastures and acorn grounds ; indeed, in many instances there was little left in them but old stumps ; and where the cattle permitted the growth of young trees, the ground was taken possession of by beech and hornbeam. At the same time, valuable beech and pine forests, extending over thousands of acres, were cut or burnt down, with the deliberate object of turning them into

pastures, which were then considered to have more value than forests yielding no revenue. The oak forests will now gradually be restored ; but very few of them, except in Slavonia, can be worked for a long series of years. It was formerly the practice to permit grazing during the fellings and the years immediately succeeding them, and numbers of cattle were bred who passed their whole lives in the forests ; it must therefore be considered a fortunate circumstance, that, after the valuable trees were felled, a crop of shrubs was able to spring up here and there and afford some shelter to the ground.

Subsequent to the year 1850, an inconceivable amount of harm was done, the forests near the principal lines of export, or situated in the vicinity of towns and manufactories, having been worked far too heavily. At this time also, forests of large extent were conceded to communes, who, not sufficiently understanding their value, destroyed them ; and the timber and even the soil of many forests, the property of joint owners, was sold by the co-proprietors, who preferred the small sum of money they could then raise on them to the permanent revenue they might ultimately have obtained under the more favourable conditions of the future. Considerable areas also were cleared for cultivation, and the result was in many cases disastrous ; as for, instance, along the banks of the Danube, the Tisza, and the Temes, where formerly fine oak forests grew, but the ground is now occupied by marshes. A recent case of this kind occurred near Arad, on the Maros, where, the forest growth having been cleared away, the soil rapidly deteriorated, and is now fitted neither for agriculture nor for forest.

Owing to the above causes, the condition of the forests, especially those which belong to communes and private proprietors, is at the present time very poor—excessive felling, imperfect regeneration, and uncontrolled pasture having led in many localities to the most melancholy results ; as witness the shrub forests on the higher mountains, the moving sands of the Alföld or great plain lying between the Danube and the Tisza, and the stony avalanches of the Karst between Trieste and Fiume, where the soil, when protected by forests, was extraordinarily fertile, but now the limestone rocks have been completely denuded ; and if the country is to be allowed even gradually, to recover itself, the exclusion of cattle, sheep, and goats from the whole area, by successive blocks, is an absolute necessity.

But although, on the re-establishment of a constitutional Government in 1867, matters began to mend, little real progress was made until 1879, when the present Forest Law was passed. This not

only ensure the proper management of the forests, but regulates the floating of loose logs and timber rafts, as well as the transport of forest produce by land, thus protecting both the owners of forests and the timber merchants, as well as the persons through or over whose property the produce passes ; and the forests are now under proper control throughout the entire country.

The old way of working was not one calculated to develop a good system of sylviculture ; but now, as the forests become thinner and wood dearer, mountain sides being denuded and river banks undermined, the necessity for the early introduction of a better system is realised, and people begin to appreciate the new law, which, if it came at the last moment, did not come quite too late ; and under it a good and certain forest revenue may still be looked for.

The excessive fellings practised between 1850 and 1880 so reduced the stock of timber in the forests, that they have not now, with comparatively few exceptions, sufficient to enable their rational management to be at once undertaken. It has been calculated that the stock remaining is not more than two-thirds of what it ought to be, and a due proportion of age-classes is rarely found. On the other hand, however, in about one-fifth part of the entire area, the forests which here consist principally of beech, but partly also of conifers, cannot yet be worked on account of the absence of export roads, which, in many cases, it will not at present pay to make ; and these forests will, as they are gradually opened out, supply the home and foreign markets for some years to come. The statement, then, which is often heard, that there is still a great stock of wood in the forests, is only true regarding parts of them. It is said that in the State oak and fir forests, the stock of timber falls short of what it should be by 575 and 649 millions of cubic feet respectively, while in the beech forests the stock is in excess by 1,013 millions of cubic feet ; and the condition of the forests owned by other proprietors is certainly not more favourable than this. The all-round density of the forests is probably not more than from 6 to 7, and the younger age-classes, where they exist, are, generally speaking, in an unsatisfactory condition. It used to be the custom to sell, in addition to the ordinary fellings, the ash, elm, maple, and other species found scattered here and there throughout the forests, and on this account it is now very difficult to obtain wood of these kinds at reasonable prices.

Until recently, then, rational treatment was, especially in the communal and private forests, almost completely neglected. Now the forests are managed as high forest, coppice, or coppice with standards, in the following proportion, *viz.* :—

| | Square Miles. |
|---|---|
| High forest, with a revolution of 80 to 120 years, extending in rare cases, to 160 years in the oak forests, ... ... ... ... ... | 25,367 |
| Simple coppice, 10 to 60 years,... ... ... | 10,028 |
| Coppice with standards—standards 80 to 120 years, coppice 20 years, ... ... ... ... | 64 |
| Total, ... | 35,459 |

In the State forests the proportion is as follows, *viz.*:—

| | Oak. | Beech and other broad-leaved Species. | Conifers. | Total. |
|---|---|---|---|---|
| High forest, ... ... | 924 | 2,795 | 1,493 | 5,212 |
| Simple coppice, ... ... | 18 | 70 | ... | 88 |
| Coppice with standards, ... | 2 | 1 | ... | 3 |
| Forest of Protection (selection method), ... ... | 2 | 84 | 164 | 250 |
| Total square miles, ... | 946 | 2,950 | 1,657 | 5,553 |

Regeneration by natural means is resorted to as far as possible; but both early and late frosts are very frequent, so that a crop of seed cannot be looked for oftener than once in five years, and since the year 1880 regeneration by planting or sowing has been largely practised. During 1884 the following areas in the State forests were regenerated by natural and by artificial means respectively, *viz.*:—

| | | | Square Miles. |
|---|---|---|---|
| Natural, ... ... ... ... ... | | | 26 |
| Artificial, | Sowing ... ... ... | 8 | |
| | Planting, ... ... ... | 11 | |
| | | | 19 |
| | Total, ... | | 45 |

The total cost of the sowing and planting work was £4,183, or 6*s.* 10*d.* per acre for sowing and 7*s.* for planting.

The spruce, *Abies excelsa*, is the most important of the conifers found in Hungary. It is, generally speaking, grown unmixed with other species, and the forest is clean-felled, the ground being restocked artificially two years afterwards. The advantages of growing forests composed of a mixture of species has not yet been fully recognised, except in the State forests, where in suitable regions, when the production of large timber is aimed at, it is now

the rule to mix spruce, silver fir, and beech in the following proportions, *viz.*:—

50 to 60 per cent. of spruce.
20 to 30 „ of silver fir.
10 to 20 „ of beech.

There is a great deal to be done in the way of restocking bare ground; the funds hitherto granted for this purpose being insufficient to admit of satisfactory progress being made. But the State gives out plants *gratis* to proprietors of all classes, and nearly 11 millions of them have been distributed during the years 1883, 1884, and 1885. The species principally employed are as follows, *viz.*:—The *Robinia pseudo-acacia*, which grows very rapidly, yields excellent firewood, vine props, and timber of small size; the Scots pine, which is planted out at a year old, but in some districts is without needles for a part of the year, and in the northern provinces suffers much from snow; and the black Austrian pine. The larch does very well in some districts, and considerable attention has recently been paid to it.

In former days, forest management was directed principally to the production of firewood, and this is still the case on many properties. But as soon as the improvement of communications enabled timber to be carried to distant markets, even beyond the national frontiers, and the diminution of stock caused a rise in prices, attention began to be directed to the production of large timber of good quality. During the last ten or fifteen years, however, many young oak and spruce forests have been cut for tanning bark, and a good deal of harm has been done by over-cutting for this purpose.

The minor products are at present confined almost exclusively to grass, acorns, and nut galls; the various industries which in other countries are usually found to flourish around extensive forests not having yet been developed to any considerable extent.

Grazing is, however, an important question, both on account of the large number of cattle and other animals which have to be kept alive, and also on account of the revenue it yields. The forest pastures are very extensive, and their existence is, as has previously been explained, one of the principal causes to which the present bad condition of the forests is attributable. It has been assumed that 1 buffalo, 1 horse, 3 donkeys, 3 pigs, 10 sheep, and 1 goat, each of them require as large a provision as 1 ox or cow—

| | | | | | | |
|---|---|---|---|---|---|---|
| 3 oxen | under 3 | years of age | being equal to | 2 | full-grown | animals. |
| 2 horses | „ 3 | „ | „ | 1 | „ | animal. |
| 2 donkeys | „ 2 | „ | „ | 1 | „ | „ |
| 4 young pigs | | | „ | 1 | „ | „ |
| 3 lambs or kids | | | „ | 1 | „ | „ |

And on this assumption, the equivalent of 8,300,000 oxen has to be provided for. But it has been calculated that the non-forest grazing grounds do not, at the most liberal rate of production, yield enough grass for more than 5,300,000 oxen; and as stall feeding is very rarely practised, three millions of cattle have to be provided for in the forests. But if every acre were made available which could, without risk to the crop of trees, be opened for grazing, not more than one-fourth of the three millions of oxen could be properly fed; and this fully explains why the forest pastures are now being ruined by over-grazing, while the cattle are, generally speaking, in very poor condition. Legislation on the subject is urgently needed. People in Hungary, as well as in other countries, sometimes assert that the forests do not suffer from grazing; and they cite examples to prove that they have known very well, and carefully watched for the last 20, 30, 40, or 50 years, such and such forests, which have always been full of cattle, and still continue to exist. But, notwithstanding this evidence, it is certain that, even where forests too heavily grazed over have not disappeared entirely, they have suffered severely in their rate of growth and in the quality of the wood they produce, while their complete disappearance is only a matter of time.

The damage done by fires is not so serious in the north as it is in the south and east, where shepherds frequently devastate large areas by burning them over, in order to obtain fresh pasture for their flocks. Attacks by insects, principally *Bostrichus typographus*, are frequent, especially in the eastern provinces; here also dangerous storms very often occur. It is said that in 1884 the damage done in the State forests alone, by fires, wind, insects, and the like causes, was as follows:—

| | No. of instances. | | Areas affected, Acres. | |
|---|---|---|---|---|
| Fires, ... | 76 | Broad-leaved forest, ... | 1,693 | |
| | | Coniferous forest, ... | 34 | |
| | | | | 1,727 |
| Inundations, ... | 19 | ... ... | ... | 99 |
| Wind, ... | 51 | (800,000 cubic feet of wood), | ... | 396 |
| Frost and snow, | 7 | ( 88,000 " " ), | ... | 956 |
| Rats, ... | 12 | ... ... | ... | 405 |
| Insects, ... | 17 | ... ... | ... | 3,415 |
| | | | | 6,998 |

In 1867 there were only 1,390 miles of railway in the kingdom, now there is a network aggregating 5,530 miles all over the country; and no less than 18 per cent. of the merchandise carried by goods train, and by the Danube Steam Navigation Company, con-

sists of forest produce. Twenty miles of narrow-gauge railway have been constructed for forest purposes. There are also

| | | |
|---|---|---|
| 4,460 | miles of | State roads. |
| 23,005 | „ | Departmental roads. |
| 35,983 | „ | Communal roads. |
| 1,799 | „ | rivers and canals which can be used for floating wood. |

The State roads are kept in good order, but those belonging to communes are not so. In addition to the above, the State has 148 miles of dry slides, and 65 miles of wet slides, with 93 reservoirs constructed for floating purposes, and holding 175,000,000 cubic feet of water. There are also 62 booms, aggregating 8,040 yards in length.

The floating of timber from the mountain forests to the plains, and thence to the markets, is still largely practised, especially in the Carpathians, where, notwithstanding the huge quantity of timber, principally beech, consumed annually in the maintenance of river banks, the erection of weirs, and other works, this system is considered cheaper than to construct and repair cart-roads, which, as they are not required for other purposes, would have to be paid for entirely from the forest budget. The rates for transport by water are also, beyond comparison, lower than those for transport by road; and the latter would be enhanced if the large amount of wood now water-borne were to be thrown on to the roads.

These considerations appear to justify the existing arrangements, in spite of the lavish expenditure of wood on works connected with the floating of timber, which must strike with astonishment every visitor to these regions.

When the quantity of snow on the ground does not render this impossible, the fellings are usually made in the winter; but otherwise they are effected after the snow has melted, say about the month of May, when the sap is beginning to rise. The trees are immediately barked, the top branches being left uncut, so as to draw up the sap from the lower part of the trunk, and thus facilitate its drying. In autumn, the timber is cut up and conveyed outside the limits of the block in which it was felled; and in the succeeding winter, it is moved down to the river side, so that it may, in the spring and summer, be floated down to the markets. As the works of various kinds which have to be constructed in connection with the floating arrangements are on a large scale, and involve a very heavy outlay, the Forest officers are required to possess a complete knowledge of this branch of engineering.

Sufficient labour is, generally speaking, obtainable among the agricultural population for all ordinary work, such as sowing and planting, sliding, dragging, floating and sawing of timber, making of charcoal, and the like; but should large orders be received for cask staves, or railway sleepers, contractors bring additional workmen from the Austrian province of Carniola. It is customary to farm a portion of the forest produce to the commune, in return for the transport of a certain quantity of wood. The timber floaters are a strong hardy race, whom long practice has taught to work with safety upon the most difficult and dangerous rivers. The original workmen were Germans from the Black Forest; but there are now many "Szekelyek" from Transylvania, and Wallachians, who have learnt the business from the Germans.

A bad feature in the present system is that, partly from long custom, and partly from the prevalence of a false idea, that the standing stock is very abundant, the cutting up and working out of the produce is wastefully conducted, thus causing a loss of from 30 to 40 per cent. of the wood. As the stock of timber decreases, and prices rise, an improvement in this respect will doubtless be effected; and, when the workmen are better trained, much of the present waste will be avoided. The State employs 2,933 permanent, and 19,840 temporary hands. The former, who act as instructors to the latter, are a most useful class; and some colonies of them, founded during the last century, now form prosperous communes on the borders of the State forests.

The rates paid for daily labour are usually from 1*s.* to 2*s.* 6*d.* for a man, and from 3*s.* to 8*s.* for a cart and two horses. But work of most kinds is, as a rule, executed by contract, or by piece-work, at fixed rates.

## Administrative Organisation.

Before 1881, the direction of all forest affairs was vested in the Minister of Commerce; but in that year it was transferred to the Minister of Agriculture; and at the same time the administration of the forests was confided to a special branch, which was relieved of the management of the State agricultural property, and completely freed from all other work. Within the office of the Minister, forest business is dealt with by the Director General of Forests, who, acting as his delegate, decides, with certain exceptions, all questions that are submitted to him. His office is divided into three sections, which take up matters referring to the State forests, working plans, and inspections respectively. Each section is under a Forest Councillor. Section 17 of the law prescribes that the

proprietors whose forests come under its provisions, must employ the number of managers and guards fixed by the working plan, and this forms the basis of the organisation of the Hungarian Forest Service.

The State forests are now divided into 18 Conservatorships, with an average area of 310 square miles, each of which is controlled by a superior administrative officer, corresponding to a Conservator, who is in communication with the Director General. The Conservator directs, inspects, and controls. His circle is formed by the aggregation of a number of divisions, the officers in charge of which are under his orders. Among his various prerogatives may be mentioned the following, *viz.*:—He can engage subordinates and fix their rate of pay; grant leave within certain limits to persons of all grades employed within his circle; approve of contracts for one year relating to the conversion or carriage of forest produce; and order experiments or purchases of plant or stock to the value of £80. He can also sanction the annual sales of forest produce, in accordance with the tariff approved by the Minister, and order the erection and repair of buildings to the value of £160.

The officers in charge of divisions, of which there are 167, with an average area of 33 square miles, act under the instructions of the Conservator, to whom it is their duty to submit proposals on all subjects relative to the management and working of their forests. Authority in certain matters is delegated to them, and they are not permitted to exceed their ordinary powers except in cases of emergency. The division is subdivided into beats, each in charge of a forest guard. There are 1,272 of such beats, averaging 4⅓ square miles in extent.

Forests which come under the provisions of section 17 of the law, but are not the property of the State, are managed under the authority of the administrative committees of the 64 departments and 14 free towns into which Hungary is divided; and each of these acts through a sub-committee of three members, chosen either from its own body or among other persons skilled in forest business. The State exercises control over the actions of these committees by means of inspectors, of whom there are 20 in Hungary, each having two or more entire departments assigned to him. The committee has power to decide, in accordance always with the provisions of the forest law, all questions that are from time to time submitted to it by the communes or other proprietors; but it is compelled to take the advice of the Inspector, subject to an appeal either by them or by him, in case of disagreement, to the Minister of Agriculture. In urgent cases, the Inspector, as

the minister's representative, has power to stop fellings or other operations which he considers detrimental to the forests; and in such cases the administrative authorities and local police are bound to support him. In case the committee habitually fails in its duty, the minister can replace it by a State Commissioner; and this has once been done. The 20 Inspectors, with their 20 assistants and offices, cost the State £8,932 in 1884, and £9,360 in 1885. The supervision exercised according to law by these officers is not at present liked by the proprietors, especially by those among them who desire to enrich themselves at the expense of future generations; but the good advice they have received has undoubtedly added many thousands of pounds to the value of their forest capital. Experience continues to show the necessity for the maintenance of the existing system; and the Inspectors are now called upon to redouble their efforts in order to safeguard the public interests, and to correct the errors of the past.

The State will take charge of, and manage through its own officers on behalf of the owners, the communal forests in any department, the administrative committee of which applies for this to be done; and many of the departments have availed themselves of this privilege with the most satisfactory results. Small private proprietors may associate themselves together for the payment of the establishment prescribed by the law; and, similarly, communal forests of limited extent may be grouped together for purposes of management, and the overcharging of their budgets may be thus avoided. But if they neglect to provide, in some manner, the necessary managers and guards, the departmental administrative committee or Minister of Agriculture has power to appoint these officials.

The number and distribution of the superior officers and subordinates employed by the State is as follows:—

| | Superior officers. | Subordinates. | Menials. | Total. |
|---|---|---|---|---|
| Central office, ... ... | 27 | ... | ... | 27 |
| Inspections, ... ... ... | 40 | ... | ... | 40 |
| State forests,... ... ... | 505 | 1,342 | 264 | 2,111 |
| Communal forests managed by the State, ... ... ... | 12 | 1 | ... | 13 |
| Higher school, ... ... | 7 | ... | ... | 7 |
| Lower school, ... ... | 6 | 3 | ... | 9 |
| | 597 | 1,346 | 264 | 2,207 |

The superior officers are of the following classes, *viz.*:—

| | No. | Yearly rate of Pay, with allowances for lodging, Office, Servants, and Horses. |
|---|---|---|
| Officers corresponding in rank with Conservators, ... ... ... | 28 | £172 to £332 |
| Secretaries, ... ... ... ... | 5 | 110 " 116 |
| Superintendents of Working Plans, | 9 | 115 " 164 |
| Assistant ditto, ... ... ... | 2 | ... 60 |
| Deputy Conservators, ... ... | 27 | 98 " 142 |
| Assistant ditto, ... ... ... | 60 | 94 " 106 |
| Sub-Assistant ditto,... ... ... | 140 | 76 " 98 |
| Storekeepers and Paymasters, ... | 35 | 60 " 84 |
| Engineers, ... ... ... ... | 4 | 84 " 152 |
| Inspectors of Depôts, ... ... | 13 | 57 " 83 |
| Probationers, ... ... ... | 26 | ... 44 |
| Apprentices,... ... ... ... | 74 | 29 " 38 |
| Doctors, ... ... ... ... | 14 | 51 " 90 |
| Registrars, ... ... ... ... | 8 | 56 " 68 |
| Accountants, ... ... ... | 60 | 48 " 200 |

In addition to their yearly pay and allowances, these *officers* receive *from 25 to 60 loads* of firewood, and are permitted to cultivate from 5½ to 28½ acres of land, according to their grade. The pay and lodging allowance of subordinates ranges from £18 to £42 a year; they receive from 17 to 25 loads of firewood, and are allowed to cultivate from 4¼ to 5½ acres of land, according to grade. The annual cost of the above establishment is about £93,550, or about 6½*d.* per acre of the forests they manage.

The Inspectors receive as yearly pay, lodging, and office allowance, from £180 to £204, with an additional £80 as travelling allowance.

The Assistant Inspectors receive from £80 to £112, with £56 as travelling allowance.

The scale of pay for officers in the State service corresponds with that fixed, during the last century, for other officials of similar rank; but it is considered too low, and will probably be raised. These officers are entitled to pensions under rules passed in 1885. When necessary, officers and subordinates are accommodated with houses in the forest, the number of buildings erected for this purpose being as follows, *viz.*:—

| | |
|---|---|
| For superior officers, one to three rooms, ... ... | 69 |
| " " more than three rooms, ... | 239 |
| For superior officers and guards, ... ... ... | 867 |
| For guards, ... ... ... ... ... ... | 680 |
| Offices, ... ... ... ... ... ... | 27 |
| | 1,882 |

The service of the managers and guards employed under the

departmental administrative committees, is, like that of the State officials, permanent, and under fixed rules. They cannot be discharged except under a prescribed procedure. The great private proprietors usually pay their *employés* at a rate which is from 25 per cent. to 50 per cent. higher than that of corresponding grades in the State service ; but their appointments are not so well secured to them, and they have no regular pensions to look forward to.

In order to obtain an appointment as forest officer or manager in any of the forests which are, by the provisions of section 17 of the Forest Law, under the immediate control of the State, a candidate must be a Hungarian subject, who has completed his studies at the High School, and passed as Bachelor of Letters or Bachelor of Science. He must either undergo the course of instruction at the academy at Selmeczbánya, or pass the final examination there, or be trained in some foreign school of the same class in which all the required subjects are taught. He must then, after serving two years on probation, pass the State Forest Examination, held at Buda-Pesth, for which he cannot present himself unless he is qualified as above. The proprietors of forests which are under the provisions of section 17 cannot employ officers or managers who have not duly passed this examination. Section 37 of the Forest Law provides that no guard can, ten years after the promulgation of the law, continue to be employed in these forests unless he has passed a prescribed examination. He must, in the first place, either pass through one of the secondary schools, and then serve for a year on probation, or he must show himself to be proficient in reading, writing, and arithmetic, and serve for three years on probation ; after one or other of which tests, and as soon as he has attained the age of 24 years, he is eligible to pass the Forest Guards' Examination, held periodically in various towns throughout the country. Guards are permitted to perform their military service after they have completed their course of instruction and probation.

All officers, managers, and guards are sworn in, and they wear a uniform, prescribed, in the case of the State forest service, by the King, and otherwise by the Departmental Administrative authorities. Up to the end of 1884, the following number of officers and subordinates in Hungary had been sworn in :—

*Superior Officers.*

| | |
|---|---|
| In the service of the State, ... ... | 318 |
| In the service of other proprietors whose forests are under section 17, ... ... ... | 695 |
| Ditto ditto are not under section 17, ... ... ... ... | 589 |
| Total, ... | 1,602 |

Of these, 449 have passed the State Forest Examination.

*Subordinates.*

| | |
|---|---|
| In the service of the State, ... ... | 1,323 |
| In the service of other proprietors whose forests are under section 17, ... ... ... | 14,593 |
| Ditto ditto are not under section 17, | 6,926 |
| Total, ... | 22,842 |

Of these, 690 only have passed the Forest Guards' Examination. About one-third of the entire number of subordinates have other employment in addition to their forest duties. There are 360 sworn superior officers and 2,400 subordinates in Croatia and Slavonia. *Employés* of both grades can prosecute cases of forest offences, and, if they have been duly sworn in, their depositions constitute a complete proof against the offenders.

Private proprietors, whose forests are not under section 17 of the law, can employ whom they please; but their men must be of good character, and sufficiently instructed to be able to do their work efficiently. They have, however, at the present time, very few competent foresters.

(*To be continued*).

# A GOVERNMENT GRASS FARM IN INDIA.

In 1882, the late Major General Sir Herbert Macpherson, wishing to improve the means of providing fodder for the mounted corps of the Army, became the lessee of the sides of the Railway line between Allahabad and Sirathi, and of about 500 acres of land in the Allahabad cantonments. This land, which had long been used for grazing, he simply preserved, but the rainfall being favourable, a fair crop of grass, amounting to 25,000 maunds, was harvested. Grass cutting was commenced in July, and it was wished, if possible, to complete the harvesting before the grass seeded. But labour was difficult to obtain during September and October, the season of the *kharif* crop, and, consequently, the harvesting was not completed until much later. The quality, too, of the grass cut was inferior, and some of the hay was condemned as unfit for fodder. Altogether the result of the first year's operations could be considered only tolerably satisfactory from a grass point of view, although the accounts at the end of the year showed a small net profit.

In the next year, 1883, the area of operations was extended. Nearly all the cantonment lands, or between 2,000 and 3,000 acres,

were leased at an annual rental of Rs. 9,504, and Rs. 5,000 were paid to contractors as compensation for forfeiting their leases. In June, immediately after the commencement of the rains, this ground was ploughed as a preparation for sowing *dúb* grass on it, and fenced in to prevent cattle trespassing on to it. As in the previous year the railway land was leased for Rs. 492, and the grass on it preserved. A portion of the cantonment land was leased out for public grazing, and some of it, chiefly *kánchar* soil, on which it was impossible to grow grass, was leased out for cultivation. By these means the actual rent payable for the lands was reduced to about Rs. 2,000. Large sums were spent on cart roads so as to facilitate the manuring and weeding of the land. Some areas of barren land, upon which nothing was ever known to grow, were treated by what is known as the "gatha-bandi" method, being divided into plots, and each plot surrounded by a small embankment to prevent the rain flowing off the surface. By this method and by deep ploughing and heavy manuring, these areas were soon rendered fertile. On the ploughed land a top dressing of manure, obtained from the litter of the slaughter cattle and transport animals, was put down. Grass was cut in September, but owing to the late rains almost all the first crop was destroyed. As in the previous year difficulties were experienced in obtaining labour during the *kharif*, and cutting had to be continued until February. But as the rains lasted longer than usual, most of the grass was still succulent when cut. Some 15,000 maunds of the coarsest grass from the railway land was passed through chaff-cutters and issued to the transport animals, which consumed it greedily, although they refused it in its former state. Altogether the year's operations resulted in a considerable cash profit.

In 1884 the whole cantonment was added to the farm, the fruit trees being also rented. The railway land was given up, and a more convenient area rented in place of it. By this means the area of the farm was increased by 1,400 acres.

It was necessary to leave a portion of the area for the public to graze their cattle in, and also for cultivation, and one-eighth of the area was set aside to be rented out for these purposes. The sums realized for these lands amounted to Rs. 8,909, which very nearly paid for the rent of the whole area, although all the most suitable land for grass farming was retained.

Ploughing was commenced as before immediately after the rains. A good portion of land was manured, but with the exception of a plot or two, no land was planted with *dúb* grass roots. Experience showed that manuring was more important for grass grow-

ing than ploughing. Some three acres of perfectly barren land which had never yielded anything before, and which had not a blade of grass on it, was covered with manure about 2 inches thick, and without being ploughed, was allowed to remain in that state until the rains, when two luxuriant crops of grass were cut off the area, one in August and the other in October. Land treated in this way with cantonment sweepings yielded four to five crops of grass in the year, and from not being worth 6 annas an acre could have been sold for Rs. 13 an acre.

About 100 silos, each 13′ × 12′ × 6′ were dug in convenient places for storing the grass ; one silo in the centre of every 6 acres of meadow, the crop from this area being sufficient to fill a silo of those dimensions. These pits were filled between July and September with grass cut and thrown into the pits by the cutters, at 9 pies per maund of grass. But for these silos the grasses which ripen in August would have rotted. The construction of roads was continued, and much of the sloping ground was treated by the "gatha-bandi" method with very favourable results.

Grass for hay was cut from the 15th October to about January. A good deal of hay was lost owing to its not having been stacked in properly constructed hay cocks.

During the cold season whenever it rained and it was possible to plough, as many ploughs as could be obtained were put on to prepare the land for the following year's crop, and all manuring was completed before the following June. This proved very advantageous as it was found impossible to prepare all the land at the beginning of the rains.

The year was a very flourishing one in nearly every way. A large profit was made from the fruit trees alone, which rented for Rs. 800 from the Cantonment Magistrate, were let out to various individuals for Rs. 2,100 altogether.

In 1885, in addition to the land rented the previous year, all the encamping grounds about Allahabad were taken over by the farm, at the usual rent which had been realized by the Collectors in previous years, with a view to supplying mounted corps on the line of march with fodder.

The same land was let out for public grazing and cultivation as in the previous years, and Rs. 11,386 were realized from this source. This sum very nearly amounted to the whole rent paid for the farm.

Although a very large extent of land had been ploughed and manured during the winter months, a large portion still remained uncultivated. This was ploughed and manured during the rains,

from about the 18th June, and the land ploughed during the winter was also ploughed over again. Ploughing was completed by the 20th July. No dúb grass roots were planted, a plentiful supply having sprung up all over the farm. Every barren spot was ploughed and thickly manured with excellent results.

Owing to the "gatha-bandis" having been made in the dry season, many breaks were made in them by the wash of water during the rains. But where properly made they proved most valuable on uneven or sloping ground. Land treated in this way, which before was barren, was soon covered with grass, and cotton and castor oil plants sown on the ridges flourished well. On level land they caused considerable loss through the water lodging in the plots and rotting the grass. But the sloping ground, where the "bands" can be employed with advantage should not be ploughed, as the loose fine earth becomes washed away, and there being no moisture, the grass withers before it comes to maturity.

A considerable sum of money was spent in "bunding" a ravine to form a lake (now called "Macpherson Lake.") Along the sides of this lake large numbers of tamarind, orange and mangoe trees and bamboos were planted. The old fencing trenches round the camp grounds in the farm were replaced by sowing these trenches with babul seed, so as to form a hedge which, after a little careful pruning, soon formed an excellent defence against cattle trespass.

Weeds appeared in great numbers and soon outgrew the grass. They had, therefore, to be up-rooted at very considerable expense. It was found that the pods of the most abundant weed, the "bharurf," were eaten by camels and goats. These were therefore siloed and given to the bullocks which devoured them. This somewhat reduced the cost of weeding.

Oats were sown on the "kachar" land, (on which this cereal grows well,) for the Battery horses, and was sold at Rs. 3 per maund.

From December 1885 the farm had been placed more directly under Government as regards account. The financial report of the year again showed a very considerable profit.

In 1886 grass cutting for rations and ensilage was commenced on the 1st July. This year after considerable difficulty, and by importing labourers from a distance, the cutting was done at 6 pies a maund of green grass, instead of at 9 pies the rate paid hitherto.

Owing to the rains continuing until later than usual, hay making was not commenced until the 24th September, and was con-

tinued until the middle of December, when the third crop of grass grown was cut.

Oats and various other forage crops, such as carrots, were sown in various places, and when harvested, were issued to the transport animals with very considerable profit.

The grass lands were again overgrown with weeds, and expensive weeding was in consequence necessary. Over 4,000 maunds of weeds were siloed with grass for the bullocks. The worst weeds were used for manure. At the close of the year the profit was again considerable.

The results of the five years' working has been as follows :—

| Year of working. | *Yield and fed out to Army horses and Transport animals.* | | | | Net profit on the year's operations. |
|---|---|---|---|---|---|
| | Green grass. | Hay. | Miscellaneous crops, oats, &c. | Ensilage. | |
| | Maunds. | Maunds. | Maunds. | Maunds. | Rs. |
| 1882-83, ... | 25,000 | ... | ... | ... | 1,494 |
| 1883-84, ... | 10,708 | 17,394 | ? | 361 | 6,777 |
| 1884-85, ... | 51,873 | 29,046 | ? | 14,571 | 28,596 |
| 1885-86, ... | 14,266 | 56,789 | 965 | ? | 10,842 |
| 1886-87, ... | 56,155 | 19,950 | ? | 24,683 | 17,837 |

But the collateral advantages derived from the undertaking have been much greater than those shewn in the above tabular statement.

The value of the cantonment lands have been much enhanced; hundreds of acres of barren waste have been reclaimed, ravines filled up and roads opened out; over 8,000 fruit trees and many hundreds of other trees have been planted throughout the cantonments, and a large park made and enclosed and a lake formed.

From the experience gained in the management of the farm, it appears that the most economical way of cutting grass on a large scale in India is by *weight*, not by area, or by labourers on daily pay. At first 9 pies per maund of green grass were paid to the coolies for cutting the grass, but this was afterwards reduced to 6 pies when the crops became heavier. At the former rate some men earned as much as 12 annas a day.

The weighing takes up a great deal of time, and becomes im-

possible if left until the end of the day, when the coolies have finished their tasks. Each maund or bundle of grass should be weighed as cut; the grass cutters' names being written down at the commencement of the work, the Overseer has merely to mark the weight opposite each man's name as each bundle is brought to him by the cutter for weighment. The head Overseer totalling these figures can then pay the men at the close of the day without any delay.

The cut grass should be spread out to dry, immediately, a few coolies on daily wages being employed for this work. The hay should be turned over several times during the day, and at night it should be collected into small cocks to protect it from the dew. In the morning when the sun is hot it should be spread out again until dry, but not left drying long enough to allow all the succulent matter in it to evaporate. With a bright strong sun one full day's drying is generally sufficient, when dry the hay should be stacked into substantially built cocks.

The best time for cutting the grass is in September and October, just when the seed is ripening, but before it has fallen. When the ground is cultivated and the rain sufficient, an early crop of grass will have to be cut in July. This, where there is much rain, will be lost if not "*siloed.*" Well manured lands will give four or even five crops of grass between June and December, and will sometimes yield as much as 500 maunds of green grass per acre in the twelve months.

To obtain a good crop of hay the ground must be carefully cultivated. Grass like other crops requires ploughing, manuring, and weeding. A country plough with bullocks and driver can be hired during the slack season for 4 annas a half day, or 8 annas a full day, and each plough is supposed to turn up about three-quarters of an acre a day. This contract ploughing requires, however, great supervision, as the drivers, to spare their bullocks, will not plough deep if they can avoid doing so. There are three holes at the top of the shaft of the plough. If the first hole is used the ploughing will be deep; not if the others are used. Another trick the drivers have for saving their animals is to tighten the rope, called the "nadha," which connects the yoke with the shaft of the plough.

The best season to plough land intended for grass is during the winter months; advantage being taken of every shower of rain, as the ground, except during or immediately after rain, is often too hard for the plough to break it up. Ploughing during the monsoon rains kills the young grass germinating from the seed

which fell during the previous year, and the benefit of the ploughing does not appear to be obtained until the following year.

Manuring is more important for grass, even than ploughing. It can hardly be spread too thickly. A good crop of grass can be obtained by simply surface manuring about 2 inches deep. Litter from the farm yard, or sweeping, serve excellently well. Barren land ploughed and surface manured with the cantonment sweepings yielded five crops of grass in the year. The manuring should be done together with the ploughing during the winter months. Although it may be thought that the best part of the manure spread during the winter will be wasted, experience shows, that for grass it answers best, because it keeps the land soft during the summer months and shelters the roots of the grasses.

Barren and bare soils are often so hard that they can only be ploughed, while they are softened by the rains. If after ploughing and manuring such lands a crop of gram, which does not require a rich soil, be put down in October, the proceeds will almost defray the expense of reclaiming the land.

Weeding will often be necessary if a good grass crop is required, and will prove expensive ; but there is nothing for it but to uproot the weeds. The operation will in the end pay through the improvement of the crop. Captain Wingate, Assistant Commissary General, began the Allahabad Grass Farm in 1882, and carried it on for three years under the orders of that distinguished officer the late Sir Herbert Macpherson. Sergeant Overseer Meagher, who was trained under Captain Wingate, has continued to carry on this grass farm on the same lines with yearly increasing success. The Overseer is described as a man of untiring zeal and energy, of exceptional educational attainments for his class of life, and of the strictest integrity.

The lesson taught by this singularly successful experiment might, perhaps, be utilized in the Punjab in connection with the so-called Military Rakhs, or areas set apart for providing the troops with fuel and grass, and, indeed, in other cases too.

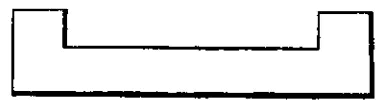
W. E. D'Arcy.

---

## SLEEPER SLIDE.

During an inspection of the Mandi State forests, I had an opportunity of seeing the sleeper slides constructed by Mr. C. E. Fendall, Manager of the Mandi Forest Company, and late an Assistant Conservator of Forests in the Punjab, a short account of these may be acceptable to your readers.

There are two slides, one 6 miles long in the Godwa forests, and the other 4 miles in Godanu. These forests are situated about 20 miles from the Sutlej river, the khud or mountain stream is only workable for sleepers for 14 miles, the problem was how to get the sleepers over the intervening 6 miles. Last year Mr. Fendall erected two small slides about 1½ miles, and their success led him to adopt the same plan. But whereas last year he had utilised sleepers and scantlings (5″ × 4″) in the construction, he could not afford to lock up such an immense number as would be required for 10 miles, so he bought inferior pines and sawed up boards 12′ × 15″ × 3″ and 12′ × 10″ × 3″, the 3 inches was subsequently reduced to 2½ inches. The main idea is the old one in use in the Jaunsar (North-West Provinces) forests, *viz.*, a frame (sikanjá) of form shown, as heavy as possible.

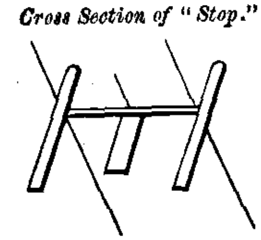


The total length of the "sikanjá" is 30 inches, but this is not constant. In the frame is placed horizontally first the 15 inch boards, and then on each side of it vertically 10 inch boards. Where there is a straight run for the slide, the breadth is reduced from 15 to 13 inches, and even 12 inches, the size of the sleepers being 10′ 3″ × 10¼″ × 5¼″. This is all simple enough, but there are some few little dodges which I think will be usefully recorded here. In the first place plane the edges of the bottom boards, and the inner portion of the side boards where they touch the bottom boards, then drive your wedges home so as to tighten it all up. Then pass a saw down both sides of the bottom board, so as to give it a rough edge; having done this loosen your wedges, ram in moss as tight as you can, and then finally tighten your wedges. Secondly, always have a "sikanjá" in the middle of one length; if this is not put in, you will never get the moss to stay in its place. In bad places have two "sikanjás." In all curves have the outer edge slightly higher than the inner, this tends to make the sleeper constantly slip towards the inner side, saving wear and tear on the outer boards. Thirdly, have as big curves as the ground to be traversed will allow of. A big curve of course increases the length of the slide, and is therefore more expensive, but it is amply repaid by the sleepers not having a chance of jamming. Mr. Fendall tells me he tried the plan of making a slide without any pools in its entire length, and it was a ghastly failure. Have a pool in at least quarter of a mile, and side canals bringing in water wherever they can be erected. Slide-men when hurried are apt to put sleepers into the slide too quickly one after the other. Never allow this,

but let each sleeper get well away with a large quantity of water behind it. In this way you will have less chance of the sleeper being left behind the water. If you have 5 inches of water running into the slide, and the joins are fairly watertight, then two to three sleepers per minute will be a good rate at which to send off, or in great slopes one per minute, so as to allow time for the water to refill the slide after the passage of each sleeper. *Never send a sleeper down a damp slide*, it gets such a pace on that it knocks the slide to pieces, besides being dangerous to the men working about it.

*Bunds.*—As before noted a pool is required at least every quarter mile to make the bund divert the water so as to run in one small channel, then commence the stone work, filling up all cavities with well rammed earth. Fill up the face of the bund with at least 2 feet of well rammed earth or sods, then shut up the hole you have left for the escape of the water. You will of course have been careful, first of all, to have a stone ready *accurately* fitting the escape hole; if you have not done this, you will have no end of trouble, and the cost of making the bund watertight will be great. Never have the top of the bund higher than the side boards of the slide. Let flood-water pour over the whole of the top of the bund. If you try to imprison it so as to go over one portion, that portion is bound to go, and the gap will tend to constantly increase in width. Make the mouth of the slide where it leaves the bund, 20 inches wide for two joins, and have these two joins *level;* this saves a lot of trouble in sending off sleepers. If water gets low, you can easily diminish the width, *but keep the two joins level.*

*Cross Section of "Stop."*



*Stops.*—On very steep slopes use "stops" to break the fearful pace the sleepers get on. Have the bottom board of the slide where the stop bangs after the passage of each sleeper well backed up, and have side guides.

F. O. LEMARCHAND,
*Kangra Division.*

---

## PINE RESIN IN JAUNSAR.

ABOUT 20 maunds of crude resin have now been subjected to distillation in the chemical laboratory of the Imperial Forest School. Neglecting waste, the result is as follows :—

| | Yield in Oil. | Yield in Colophony. |
|---|---|---|
| *Pinus excelsa,* .. .. | 22 per cent., | 78 per cent. |
| *Pinus longifolia,* .. .. | 18 „ | 82 „ |

The crude resin was brought into a copper retort, melted and then heated under admission of a small supply of water. Equal quantities of water and of oil of turpentine began to distil over, the two liquids separating from each other according to specific gravity. The proportion of oil diminished gradually, and when it had been reduced to about one-tenth of the volume of the water, the process was stopped. The remaining liquid resin was poured into an iron vessel and heated briskly to drive out all volatile matter. After cooling, a clear semi-transparent solid resin of amber color (colophony) was left. The oil of turpentine was collected and shaken with water and litmus solution. The litmus became red owing to acetic acid present, and a further shaking after addition of a little sodium carbonate, restored the blue of the litmus, indicating that the oil had been thoroughly freed of acid. This neutral oil was then allowed to stand, and after about four days it became clear and ready for use.

The presence of acid in the crude resin is proved without any doubt. By adding sodium carbonate to neutralize the acid in the distilled water of *Pinus longifolia* resin, I produced a salt which I afterwards treated in a glass retort with strong sulphuric acid. The result was a very pure strong acetic acid.

There is a great difference between the resin of *Pinus excelsa* and of *Pinus longifolia*. The former produced a mere trace of acid, so that a treatment with soda was almost unnecessary. The latter, however, gave a larger amount.

The oil contained at first about $\frac{1}{1600}$th part of acid, and during the ordinary process of distillation, the crystallised soda, which was required to neutralize the resulting oil and water from *P. longifolia*, amounted to about 0·2 per cent. of the crude resin. This implies the presence of about 0·1 per cent. of acetic acid in the crude resin. But on continuing the distillation with water for five days, the acid which distilled over with the water amounted to about 0·25 per cent.

In Sir D. Brandis' N.-W. Forest Flora, page 508, it is said that soda is used in the Punjab during the distillation of oil of turpentine. I mixed soda up to 2 per cent. of the crude resin with the latter in the retort, but this had not the effect of removing the acid. Even an addition of 2 per cent. pure sodium hydrate (caustic soda) to resin, out of which almost all oil and a great deal of acid had already been expelled, did not stop the evolution of acid when the distillation with water was continued. It appears to me impossible to remove the acid in the retort itself by means of a moderate addition of soda.

Yet this would be very desirable, because the acid vapours mixed with some air oxidise the metals of which retorts might be made, iron, galvanized iron, copper. Only tin resists. I was therefore obliged to tin the copper retort and the cooling apparatus, and this had a very good effect. Without this I would not have been able to continue the distillation of the *Pinus longifolia* resin. But the *Pinus excelsa* resin could be distilled in a retort of galvanized iron, there being so very little acid present.

The oil of turpentine of both these trees has an agreeable scent, but much weaker than the oil of turpentine of the trade.

Oil of turpentine and colophony command the following prices, according to information kindly procured by Messrs. Gillander, Arbuthnot and Co., Calcutta.

*In England, reduced to Indian weight and coin*—

| | Rs. |
|---|---|
| Oil of turpentine, one maund, ... ... ... | 15 |
| Colophony, one maund, ... ... ... | 3 |

The local wholesale prices at Dehra Dún, N.-W. Provinces, are about—

| | Rs. |
|---|---|
| Oil of turpentine, one maund, ... ... ... | 25 |
| Colophony, 1 maund, ... ... ... | 5 |

whilst the actual bazaar *retail* prices are *double this amount*.

It is certain that the local prices are higher that those in England, and the local market must first be entirely supplied by Indian product before export can be thought of.

From the yield of oil and colophony given above and the local prices, we obtain the actual value of the products of distillation after deducting about 5 per cent. for waste. The crude resin of *P. excelsa* is then worth about Rs. 9, and that of *P. longifolia* about Rs. 8 per maund of 82$\frac{2}{7}$ lbs.

A local demand for the colophony has also arisen at the works of the N.-W. Provinces Soap Company, Meerut, which at present uses American colophony.

DEHRA DUN, H. WARTH.
20*th November*, 1888.

---

## SEEDING OF *PROSOPIS SPICIGERA*.

I NOTICED while examining a forest this morning, that there were seeds on a few khandi (*Prosopis spicigera*) trees. I am told that this is the third time the trees have seeded this year, a circum-

stance never known before in this part of India. Perhaps some of your readers may have seen or heard of this, in which case I should be glad to know to what they attribute the cause. I may mention the season has been a poor one, most of the trees not having had any water.

The bamboo, by a marvellous provision of nature, is known in some parts of India to seed only in times of drought or famine, when the seeds become an article of food, and it occurs to me that it may be the same with khandi, the seeds of which are sometimes pounded into flour and eaten.

*17th November*, 1888. G. E. M.

---

FOREST CONSERVANCY.—A Behar correspondent writes :—

That forest conservation is absolutely necessary in India no one can deny. Forest laws must be rigid to be of any use, and the Government is to blame for teaching the cultivator to howl about forest oppression. Forests, though a great good, are necessarily accompanied by some evils to the possessors of *jotes* in their vicinity. Government takes up land for railways, canals, &c., and cases thus occur in which individual hardship is inflicted, but this cannot be helped. Forests will eventually be appreciated by the bulk of the population, and it is only Government that can carry out a thorough forest conservation policy. In the wind-scorched and dried-up plains of Behar, forests are as valuable as they are difficult to preserve. In some portions of the Kaimins, Government has estates on which spasmodic attempts at conservation have been made, but in such places buffalo grazing is allowed to go on all the year round, and this is absolutely fatal. The *goala* with his axe and his buffalos does more harm in a year than the cultivator does in ten. The policy of the Bengal Government lets a great deal of the forest difficulty slide. Local officers deal with it according to their personal inclinations. One sees what should be done and tries to do it, but is transferred before his work is well begun. Another does not care for forestry, and the bother of having anything to do with it. He takes advantage of the howl against forest oppression, lets the matter slide, and works up his own particular hobby, local self-government, education, municipalities or sanitation.—*Englishman.*

## IV. NOTES, QUERIES AND EXTRACTS.

---

DISCOVERY OF FOSSIL TREES NEAR GLASGOW.—The wonderful geological discovery in one of the western suburbs of Glasgow has excited widespread interest, and has been pronounced by leading scientists to be one of the finest collections in Europe. Some years ago the Commissioners of Partrick leased 40 acres of ground at the west end of Whiteinch, and this land has since been converted into a public park for the burgh. In the ground leased was an old quarry, which had been used as a receptacle for rubbish. It had once been a wooded eminence; but the manner in which the stones had been taken from the quarry had the effect of dividing it into two elevated plateaus, with rocky and precipitous sides. It was seen that this would make an admirable retreat from a broiling sun, and the Commissioners took steps to lay it out to the best possible advantage. In January last, while a carriage-way was being cut through the quarry, one of the workmen called the attention of the foreman to a peculiar "ring" in the stone. It soon became evident that a "fossil tree" had been discovered, and later there were exposed the twisted and warped roots, as if they were living and growing. As the schist was cut through, other "rings" were bared; and now, after seven months of careful excavation, nine perfectly rooted trees with erect stems have been discovered, while two other "fallen trees"—also solid stone and perfect in shape—with several fine branches have been further exposed to view.

The circumferences of the different trees at the thickest part of the stem are given as follows :—

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 11 | feet | 4 | inches. | | 1 | 6 | feet | 8 | inches. |
| 1 | 8 | ,, | 10½ | ,, | | 1 | 6 | ,, | 6 | ,, |
| 1 | 8 | ,, | 7 | ,, | | 1 | 6 | ,, | 4 | ,, |
| 1 | 8 | ,, | 6 | ,, | | 1 | 5 | ,, | 3 | ,, |
| 1 | 8 | ,, | 1 | ,, | | | | | | |

The trees vary in height from the root upward from 1 foot to 3 feet, all having been broken off where the schist ends and the sandstone begins. One fallen tree, lying at an oblique angle to the erect trees, measures 18 feet 10 inches, while another huge one, only

partially uncovered as yet, lies longitudinally, and is about 4 feet diameter. The floor on which the fossils stand measures 64 feet by 25 feet.

As to the generic identification, some difficulty seems to be experienced. While some experts state that they are *Sigillaria*, and the roots *Stigmaria*, there are others who say they have more the character of *Lepidodendrons* than of *Sigillaria*, and even did they belong to *Sigillaria*, it must be the *Clathrate* group. Mr. John Young, who, in conjunction with Mr. D. C. Glen, prepared a paper on this subject for the Glasgow Geological Society, is of opinion that these trees are of a tremendous age, older than the human race to which they just have been revealed; older indeed than animal life of any kind, save, perhaps, a form of leech or earthworm, traces of which have been met with in the surrounding strata. He regards the strata they now stand in as a "portion of the fossil coal and ironstone series," and believes that these trees have been covered with 3,000 feet of strata which, after being laid down, has again been reduced to a few feet by denudation. In a paper read to the Glenfield Ramblers at Kilmarnock, the Rev. D. Landsborough says:—"The forest now revealed is to Scotland what Pompeii is to Italy—only Pompeii is a thing of yesterday in comparison. . . . . We listen to the birds singing in the branches of the grove which now over canopies it, and we gather flowers under their shade, but no bird ever sang or flitted amongst the branches of that old forest, flowers did not grow under their shade, nor did the foot of man, or even of a single quadruped, ever tread its sward. How dark, silent, and solitary must the old forests have been."

The Commissioners have taken the necessary steps to protect the interesting and instructive sight, and daily numerous visitors are attracted to the spot.—*Timber Trades Journal.*

---

KAWRIE PINE.—The destruction of timber seems to go on in New Zealand more wantonly than anything we have heard of in the pine forests of America, some instances of which are mentioned by Mr. Froude in his *Oceana* 1886. Travelling from Auckland to visit the Maori Reserve, about 160 miles to the south of the capital, he stops at two towns named after our universities Oxford and Cambridge, and at pages 229-30 in that interesting work we find the following scenic description:—

"We stopped at Oxford only to change horses. A few miles further on we crossed the land of the Maori, and plunged into

20 miles of unbroken forest—a forest which was a forest indeed —trees all new to me, from 160 to 200 feet high, many of them reminding me, in form and character, of the Australian gum tree, with which, I believe, they have no affinity whatsoever; as if air and climate tended to produce the same colours and outlines in organisms *entirely distinct. The kawrie pine is the grandest of the* New Zealand forest princes. He stands alone, allows no undergrowth beneath his shade, and clears an open space about him. A track had been cut with the axe for the road on which we were travelling, permission being purchased from the Maoris to whom the wood belongs. Thirty feet or so had been cleared on either side of the carriage way to let in air and light, and the vast trunks lay stretched as they had fallen one upon another, thousands and tens of thousands of the finest timber, left to rot; nay, not even to rot, for they had set them on fire where they could, and the flames spreading to the forest had seized the trees which were nearest, and there they were standing, scorched, blackened, and leafless: we went through absolutely twenty miles of this. Such lavish and wanton destruction I must have seen to have believed. The Maoris are too indolent to use the timber, and too careless to sell it; the white colonist can get as much as he wants elsewhere. It was too painful to look at, and it was a relief when we emerged into open land and sunshine."

It is a trait in the Maori character, the strong disinclination to work if they can get food, fresh air, and sunshine without it, and the rents they get by selling rights and privileges, &c., to the whites are spent in drinking bouts, spirits, as with other savage races, being their delight. Time has not improved them, as the writer recollects them some eight and twenty years ago in hundreds loitering about the streets of Auckland—men and women with pipes in their mouths, or squatted down at the wharf-side, watching with listless apathy the whites toiling at the cranes unloading ships that lay alongside, and the dusky natives would seem to betray no sign of interest in what was going on around *till one of their own* war canoes passed up the bay, when they would rise up and shout.

While large timber is becoming scarcer year by year in nearer latitudes, it is a pity that some stop cannot be put to the wilful waste in countries far off, but still accessible, and to which a constant stream of commerce continuously flows. The kawrie pine possesses *much of the durability of the* hardwood species, at the same time being easily workable. By and by this timber will come into greater use, and the regrets at the useless waste of the

fine forests that is now going on will be too late, and the great increase in the value of forest property throughout the world will awaken the colonists of these distant lands to the mistake they made in not preserving their trees from wilful destruction when they had the opportunity.

We can hardly realise trees as high as the Monument, and of equal girth, not standing singly, but in thousands, being set fire to for the purpose of clearing a roadway.—*Timber Trades Journal.*

---

THE LONGEVITY OF TREES.—Dr. Childs, who lived in Nebraska for about thirty years, and was an observer for the Smithsonian Institution, counted rings on some soft maples eleven years two months old, and found on one side of the heart of one of them forty rings and not less than thirty-five anywhere, which were quite distinct when the wood was green; but after it had been seasoned only twenty-four rings could be distinguished. Another expert declares that all hard wood trees make many rings a year, sometimes as many as twelve; but as the last set of cells in a year's growth are very small, and the first very large, the annual growth can always be determined, except when from local causes there is in any particular year little or no cell growth. This may give a large number on one side. Upon the Pacific coast of North America trees do not reach the point where they stop growing nearly as early as those of the Atlantic coast. Two hundred years is about the greatest age attained on the eastern side of the continent by trees that retain their vigour, while five hundred years is the case of several species on the western coast; and one writer is confident that a sequoia, which was measured, was not less than 2,376 years old. At Wrangel, latitude 36° 6′, a Western hemlock, 6 feet in diameter at the stump, was 4 feet in diameter, 132 feet further up the trunk, and its rings showed 432 years. But in the old Bartram Garden, near Philadelphia, not more than 150 years old, almost all the trees are on the down grade. The *Quercus robur*, England's pride, which at home is said to live 1,000 years, has grown to full size and died in this garden, and the foreign spruces are following suit. Silver firs planted in 1800 are decaying. The great difference in the longevity of trees upon the western and eastern coasts of the continents in the Northern Hemisphere seems to be due to the warm, moist air carried by strong and permanent ocean currents from the Tropics north-easterly, in both the Pacific and Atlantic Oceans, which make the climate both moist and equable in high latitudes.—*English Mechanic.*

THE GREAT LOG RAFT.—The great log raft from Joggins, Nova Scotia, went through Hell Gate at high tide about noon on Saturday last, and passed down the East River to its destination in tow of seven tugs. The leading tug had a long length of hawser, and the others were made fast to the raft, three on each side. Little excitement was caused by its passage through the Gate, but the shores were well lined by people, all of whom seemed disappointed. From the banks the raft looked like a gigantic whale or big ship bottom upwards. There was apparently a great deal more of it below the surface than above, and from its shiplike shape and the submergence apparently of the ends, it did not look nearly as long as it was reported to be. It was really 592 feet long, 55 feet wide, and drew 23 feet of water. It was built of 24,000 logs, averaging 13 inches in diameter and 39 feet in length, and containing 5,000,000 feet of timber. The raft is cigar-shaped. The logs are bound together by wire ropes and chains. Two big tugs towed it down from the Bay of Fundy, where it has been under construction since November, when Mr. Leary's other and unfortunate venture was launched. To transport such a mass of timber by the usual method would require 45 lumber schooners and cost 30,000 dollars. The two tugs for towing it only charged 4,500 dollars. It is estimated that the owners will realise 75,000 to 100,000 dollars from their venture. The timber coasting trade is alarmed, for timber in logs can thus be shipped much cheaper in raft form than on board vessels. The Government did its utmost to impose a duty upon the raft, but did not succeed. Mr. Leary will proceed to Joggins before the autumn, where another and larger raft will be built upon the ways previously occupied by the present one.—*Timber Trades Journal.*

---

THE TEAK MARKET.—Messrs. Denny, Mott, and Dickson's wood market report for July 3rd states that the deliveries last month from the docks in London were 878 loads and landing 2,216 loads.

The half-year ending 30th June shows :—

Deliveries from docks in London ; 7,906 loads, as against 6,138 loads for the corresponding period last year ; landed in London 6,626 loads, as against 4,022 loads last year ; present stocks in London 9,500 loads, as against 12,581 loads last year. The above increase of about 29 per cent. on the six month's consumption of last year and 25 per cent. decrease in the landed stocks is distinctly encouraging.

Some large orders are in hand, and this fact, combined with exceptionally important ship-building requirements—both actual and prospective—should give great strength to the market, notwithstanding that last month's important landings have again swelled the stock on hand to the above ample proportions. The continued scarcity of supplies of European quality trees from the forests, and also the large requirements of Burma itself, for barracks, &c., continue to keep prices at the shipping ports at a higher level than that of prices here, and should serve to check importation and keep supplies moderate, if holders on this side refrain from taking undue advantage of the situation by forcing up prices to a level which would check consumption and serve to cause the repetition of the old evil of indiscriminate shipments, with the inevitable result of a demoralised market.

A very satisfactory feature of the half-year has been the steady moderation and mutual consideration shown by all largely interested in this important wood, and this is not the least of the factors which have tended to restore the market to its present satisfactory condition.—*Timber Trades Journal.*

---

## MANUAL OF INDIAN SYLVICULTURE.

I HAVE received numerous enquiries regarding the date when my Manual of Indian Sylviculture is likely to issue from the Press. As an answer to these enquiries, I would ask you kindly to state that the book will be ready for sale early next month, and will be procurable from the Librarian, Forest School, at Rs. 10 per copy.

DEHRA DUN,
18*th November*, 1888.

E. E. FERNANDEZ.

---